112	112	112	112	112

S+	S+	S+	S+	S+	S+
S-	S-	S-	S-	S-	S-
G	G	G	G	G	G
S+	S+	S+	S+	S+	S+
S-	S-	S-	S-	S-	S-
G	G	G	G	G	G

101	102	103	104	105	106

FIG. 1A
(PRIOR ART)

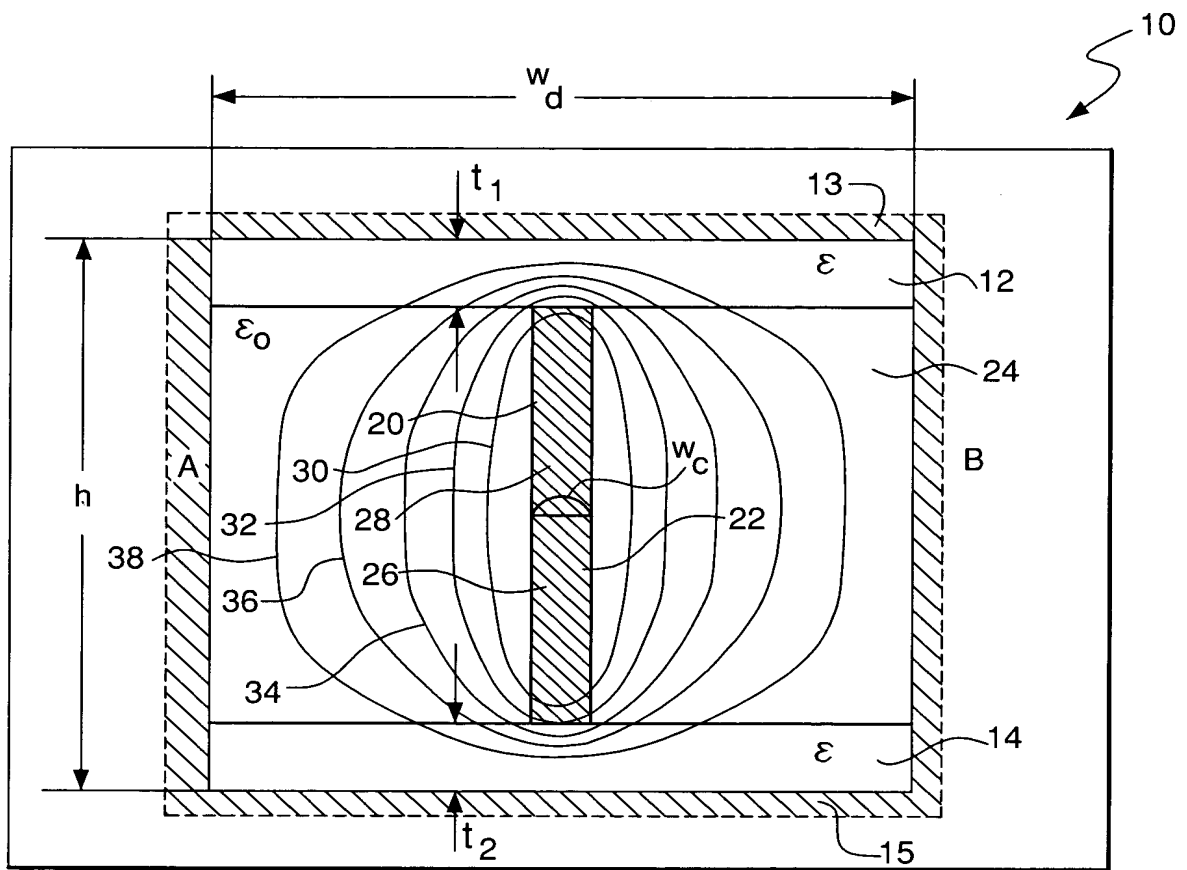| 122 | G | G | S+ | S- | G | G | } 111 |
122	S+	S-	G	G	S+	S-	} 112
122	G	G	S+	S-	G	G	} 113
122	S+	S-	G	G	S+	S-	} 114
122	G	G	S+	S-	G	G	} 115
	S+	S-	G	G	S+	S-	} 116

FIG. 1B
(PRIOR ART)

FIG. 2A
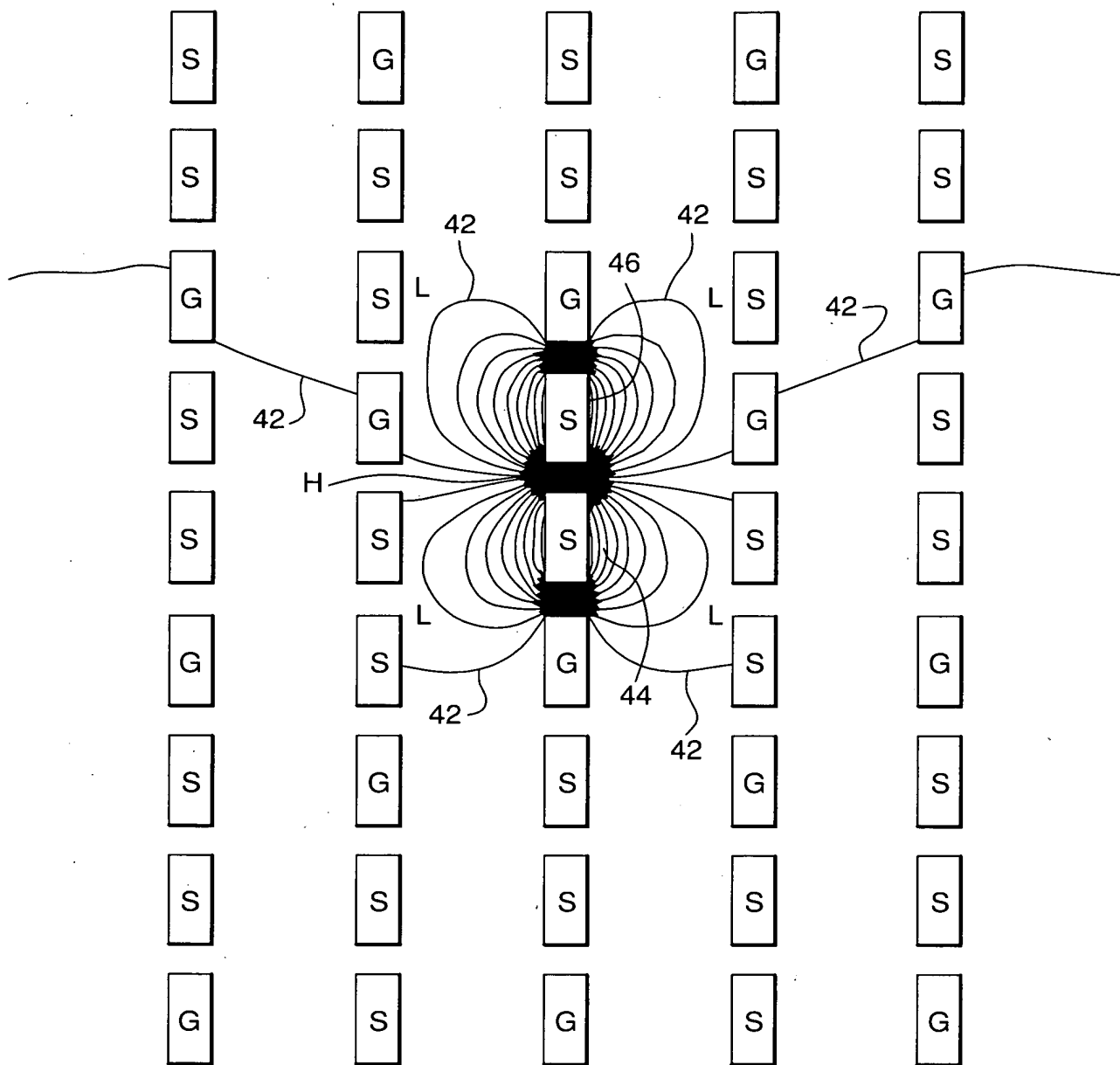
FIG. 2B
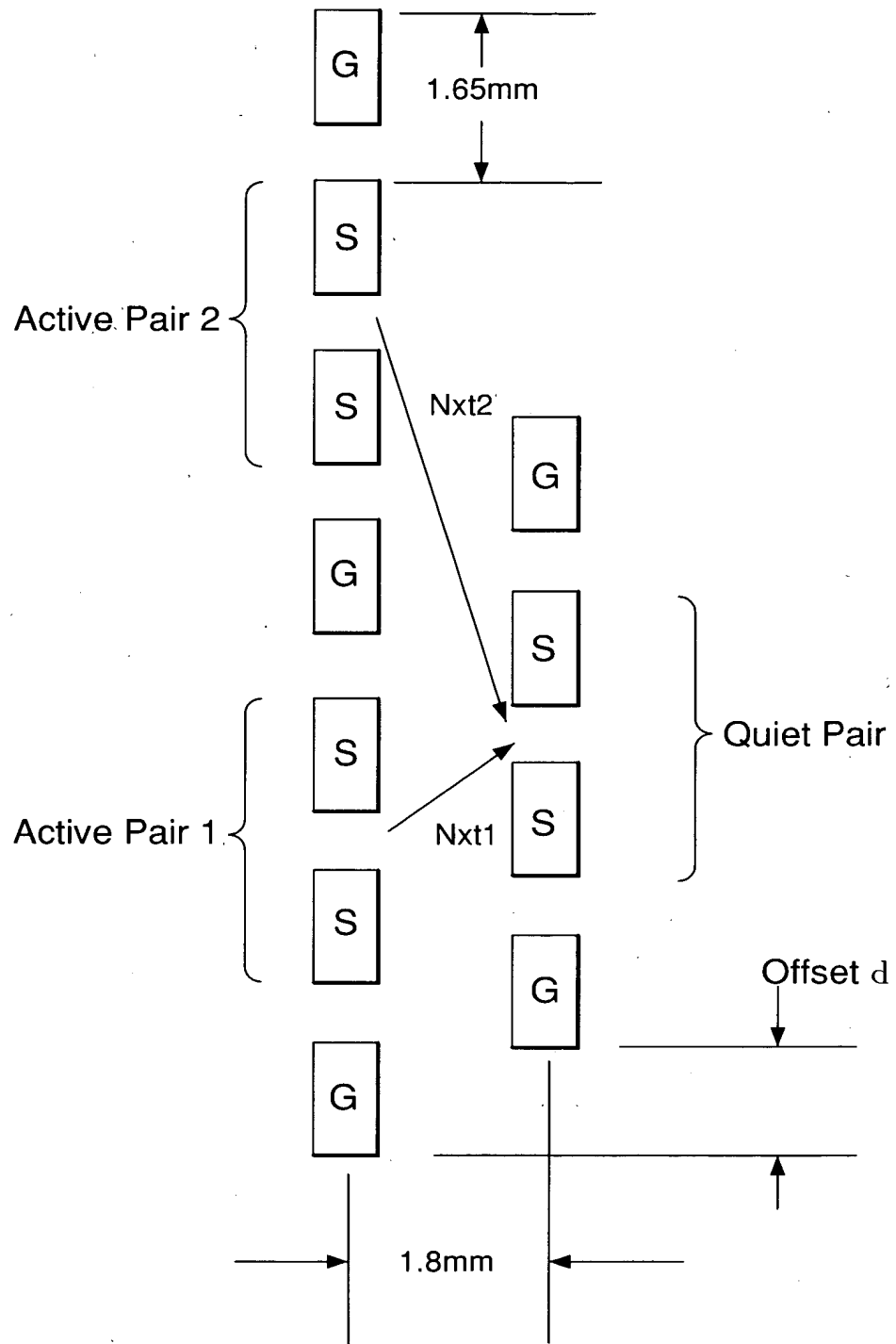
FIG. 3A
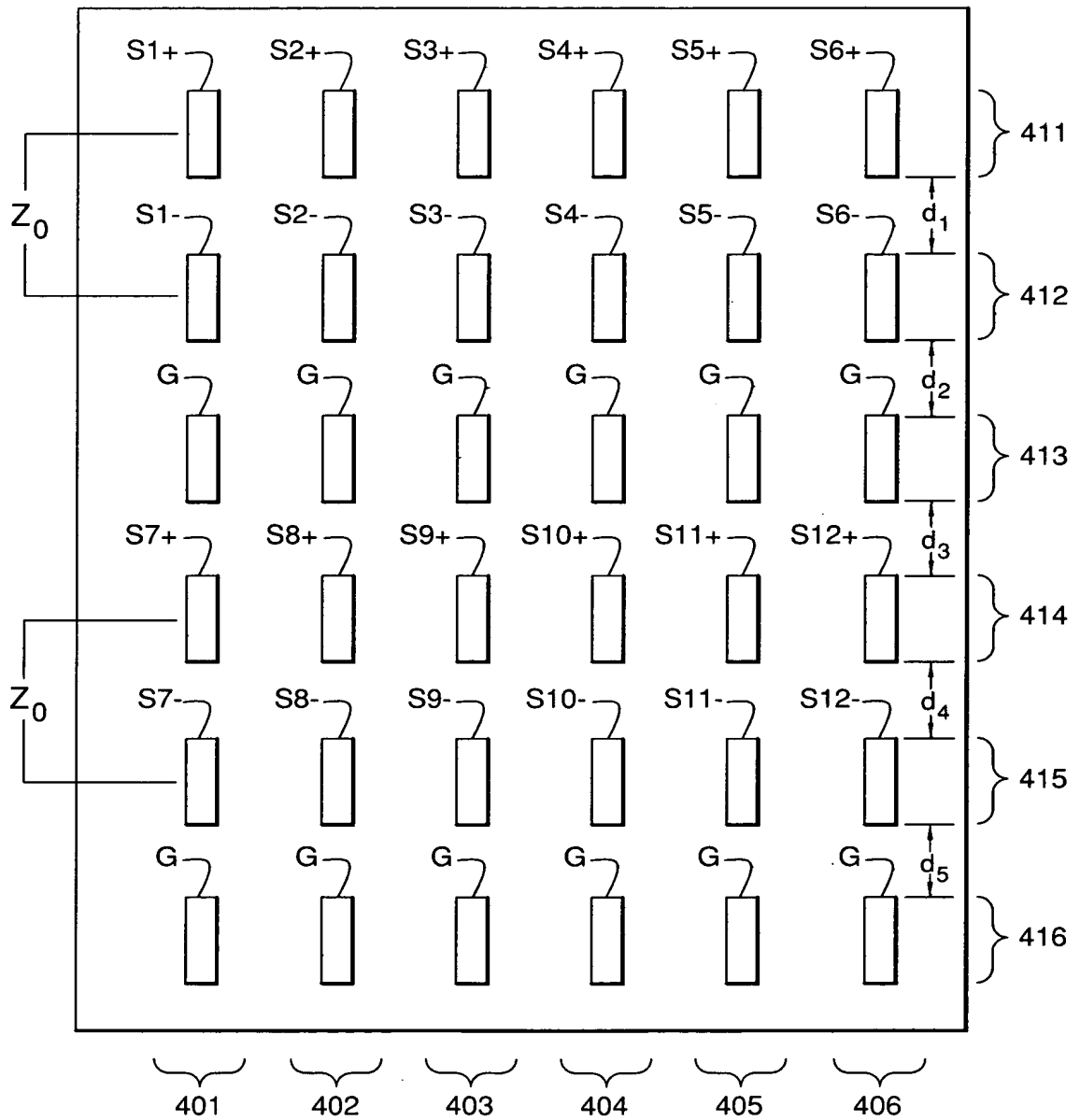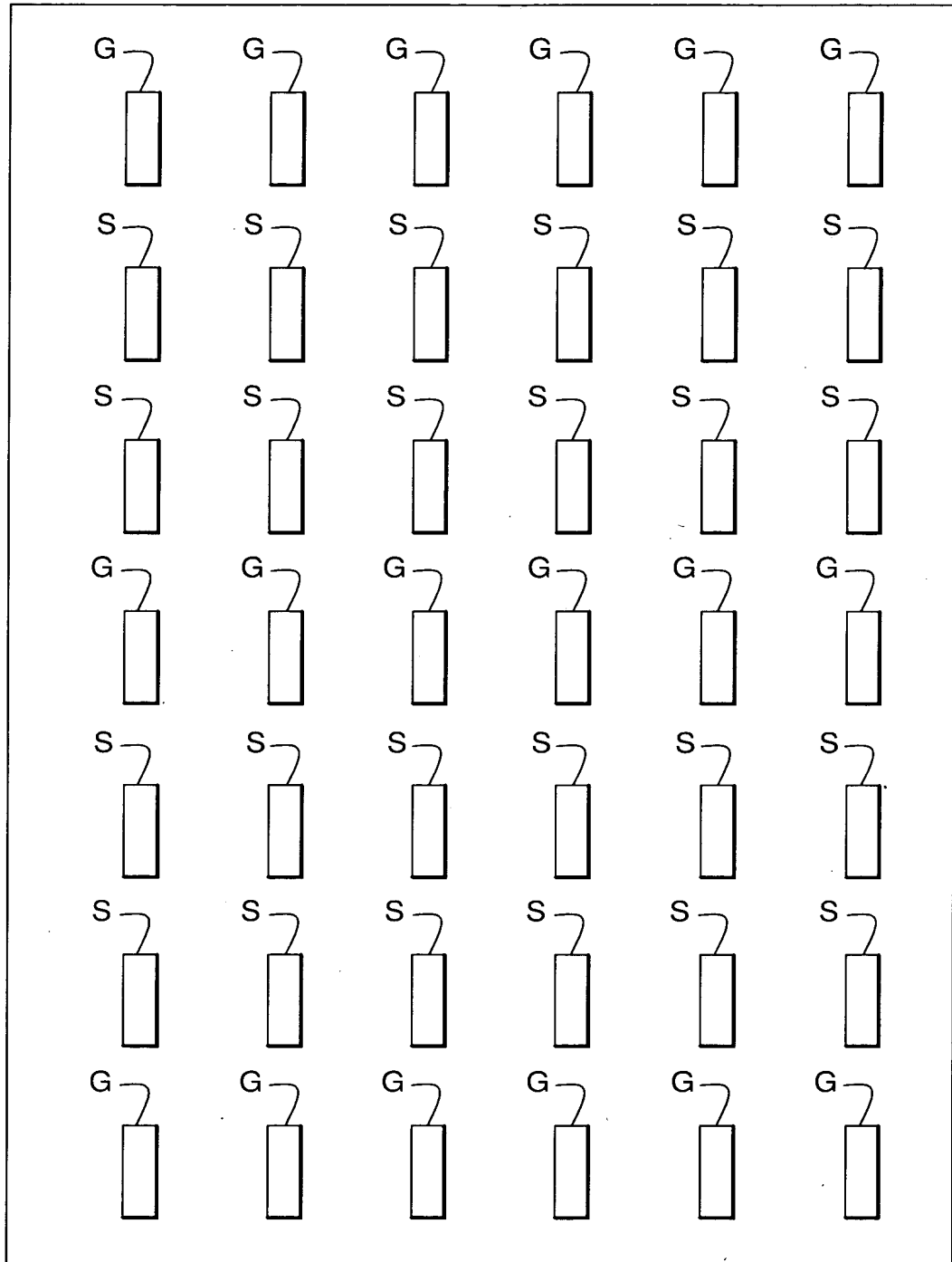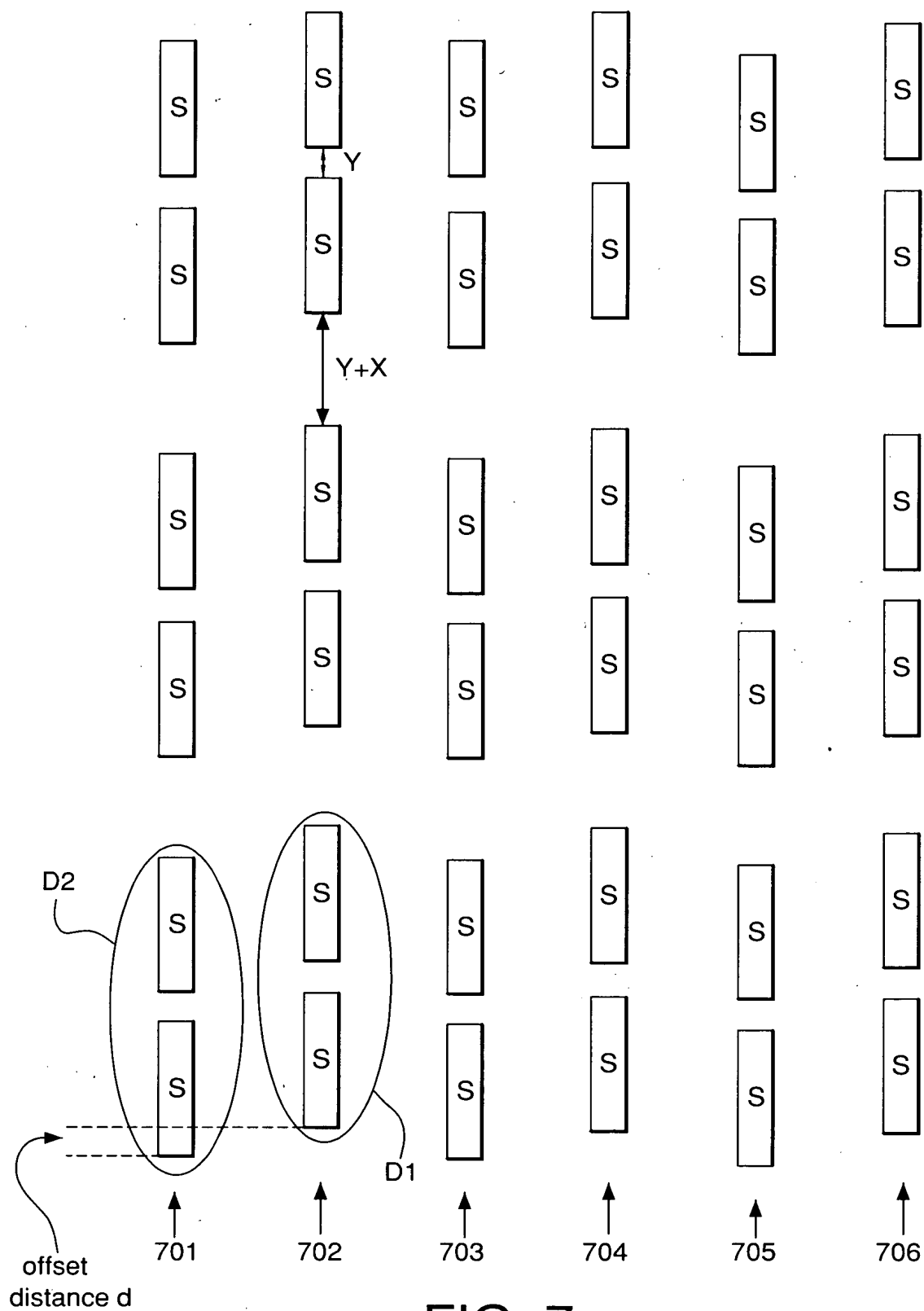
NEXT vs. Offset

1.8 mm Col Spacing, 1.65 mm Row Spacing
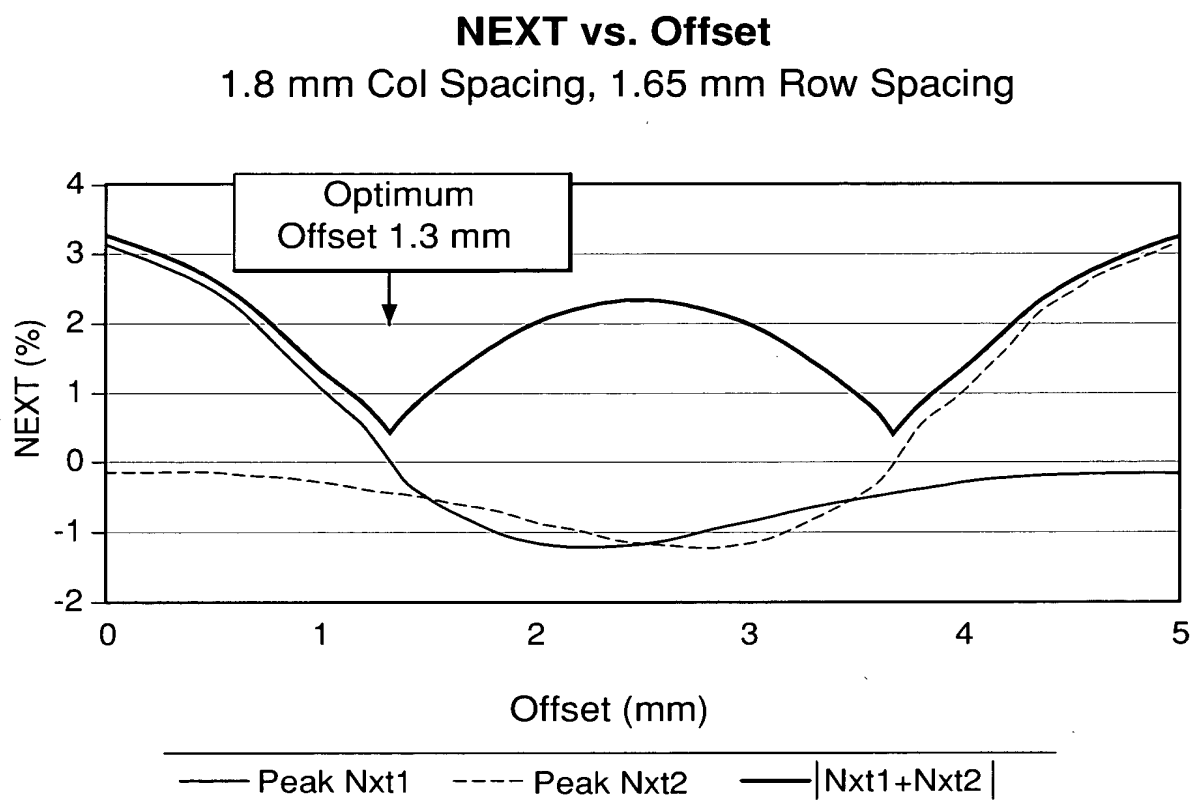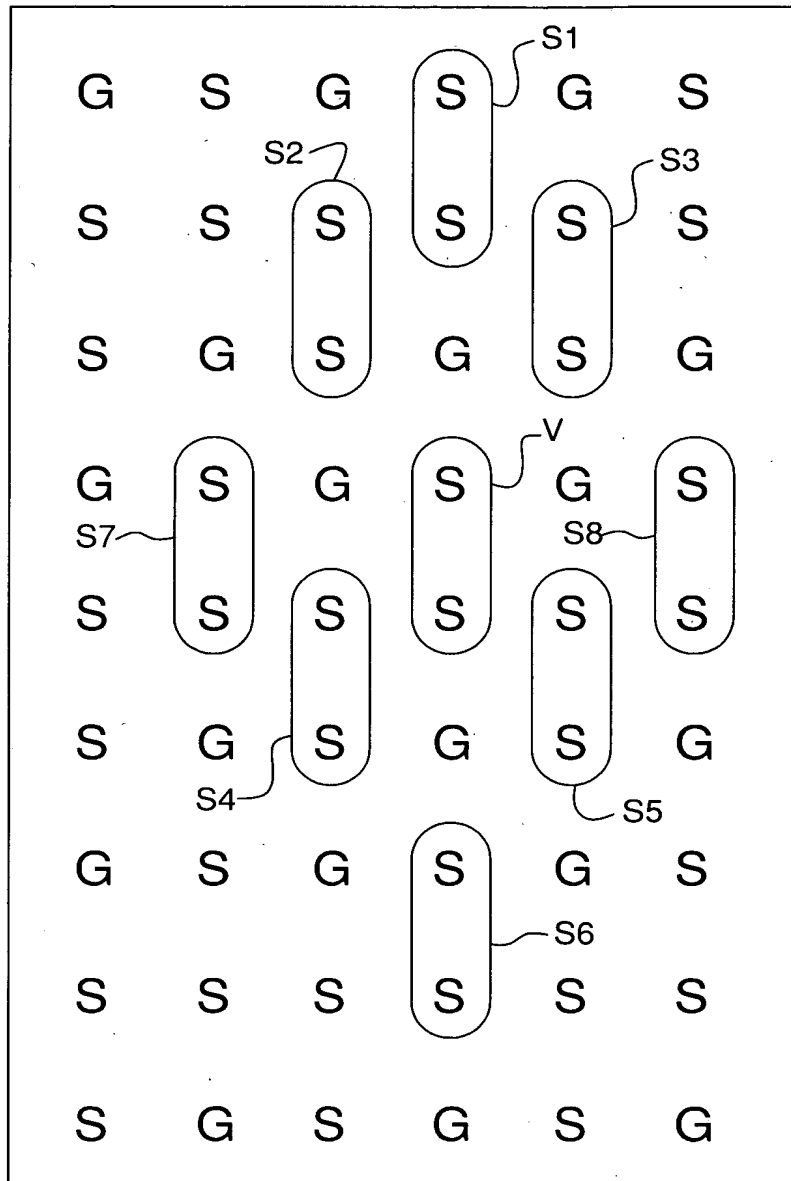

FIG. 3B

FIG. 3C

FIG. 4A

FIG. 4B

FIG. 4C

Z_0

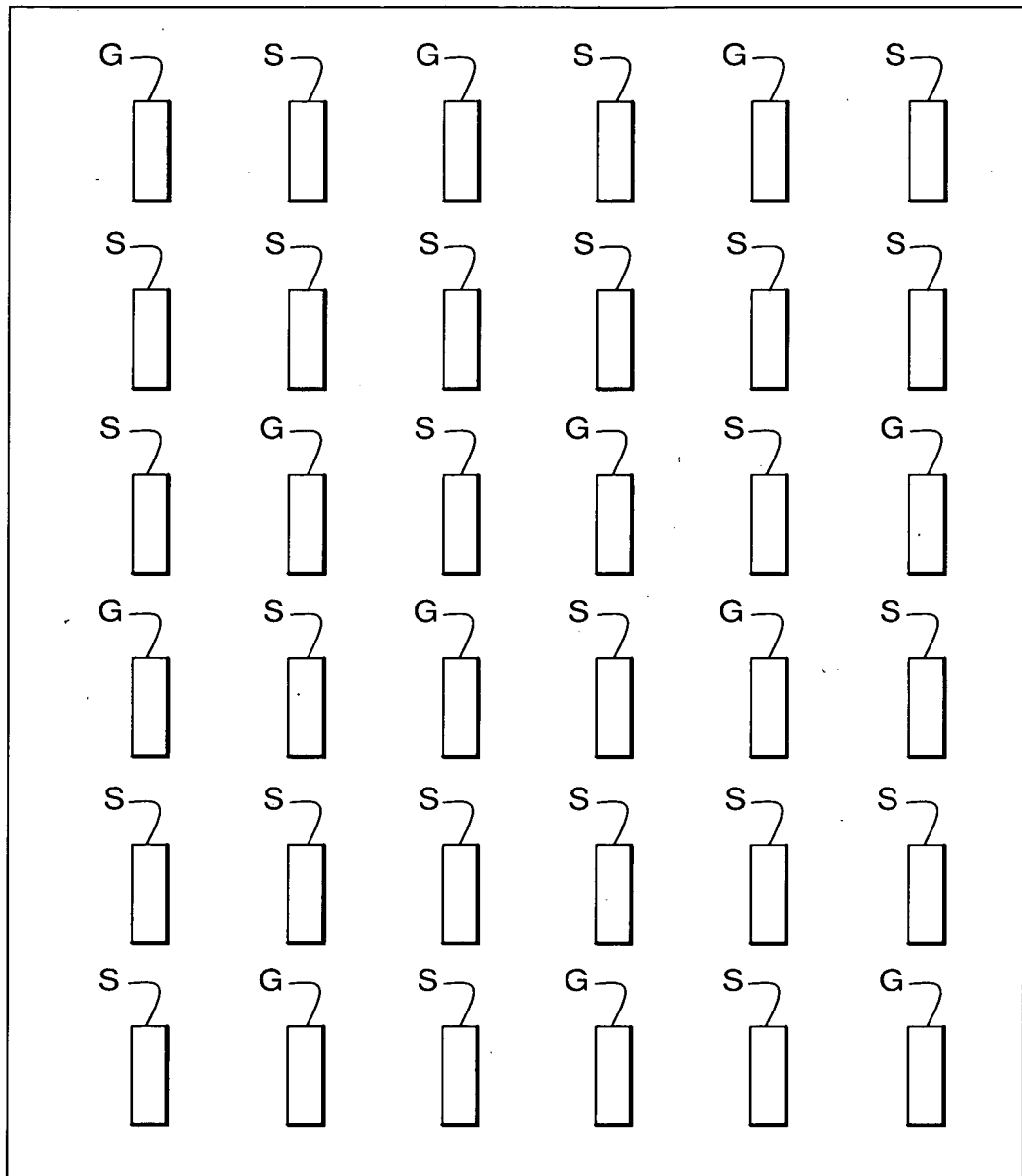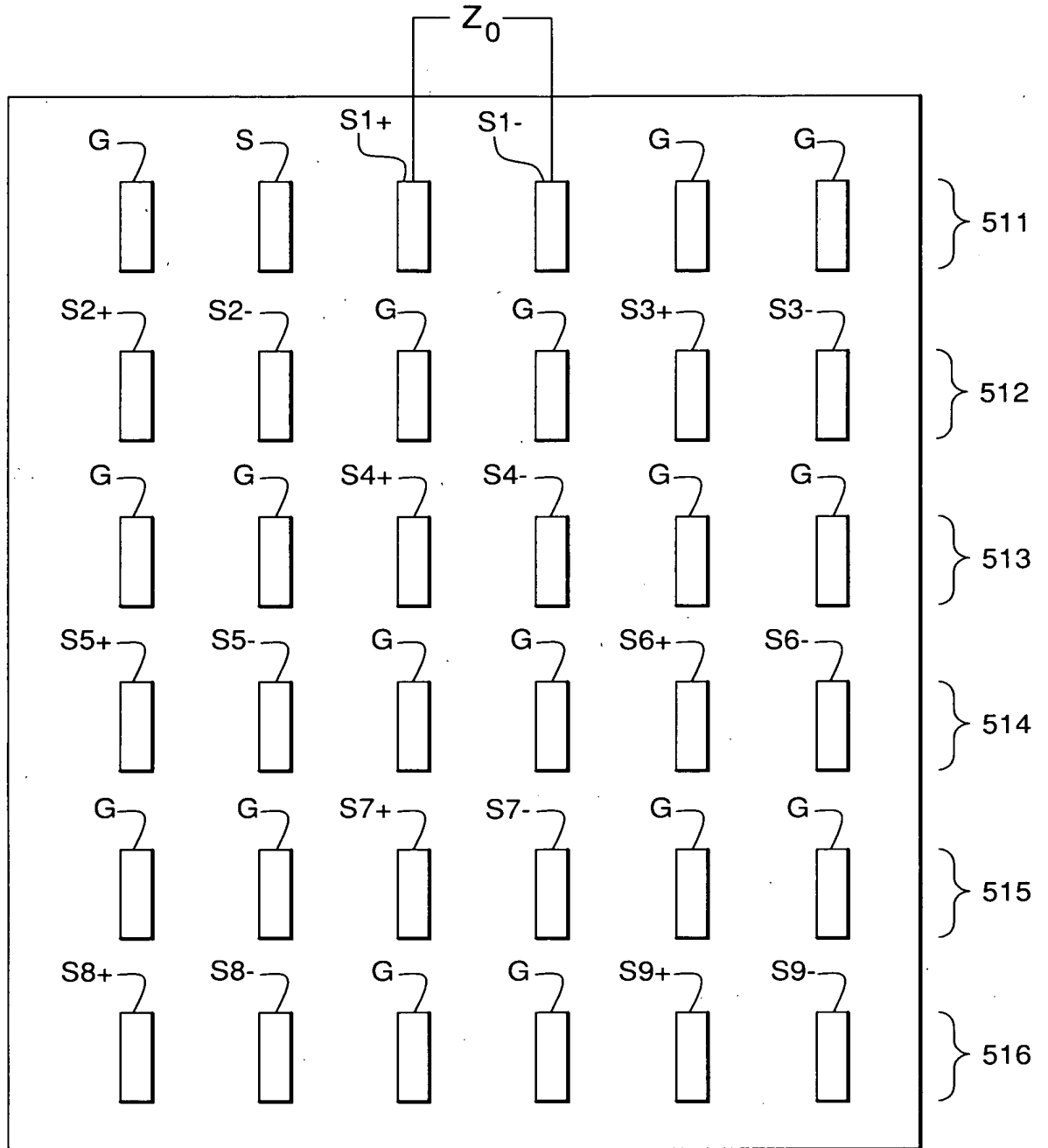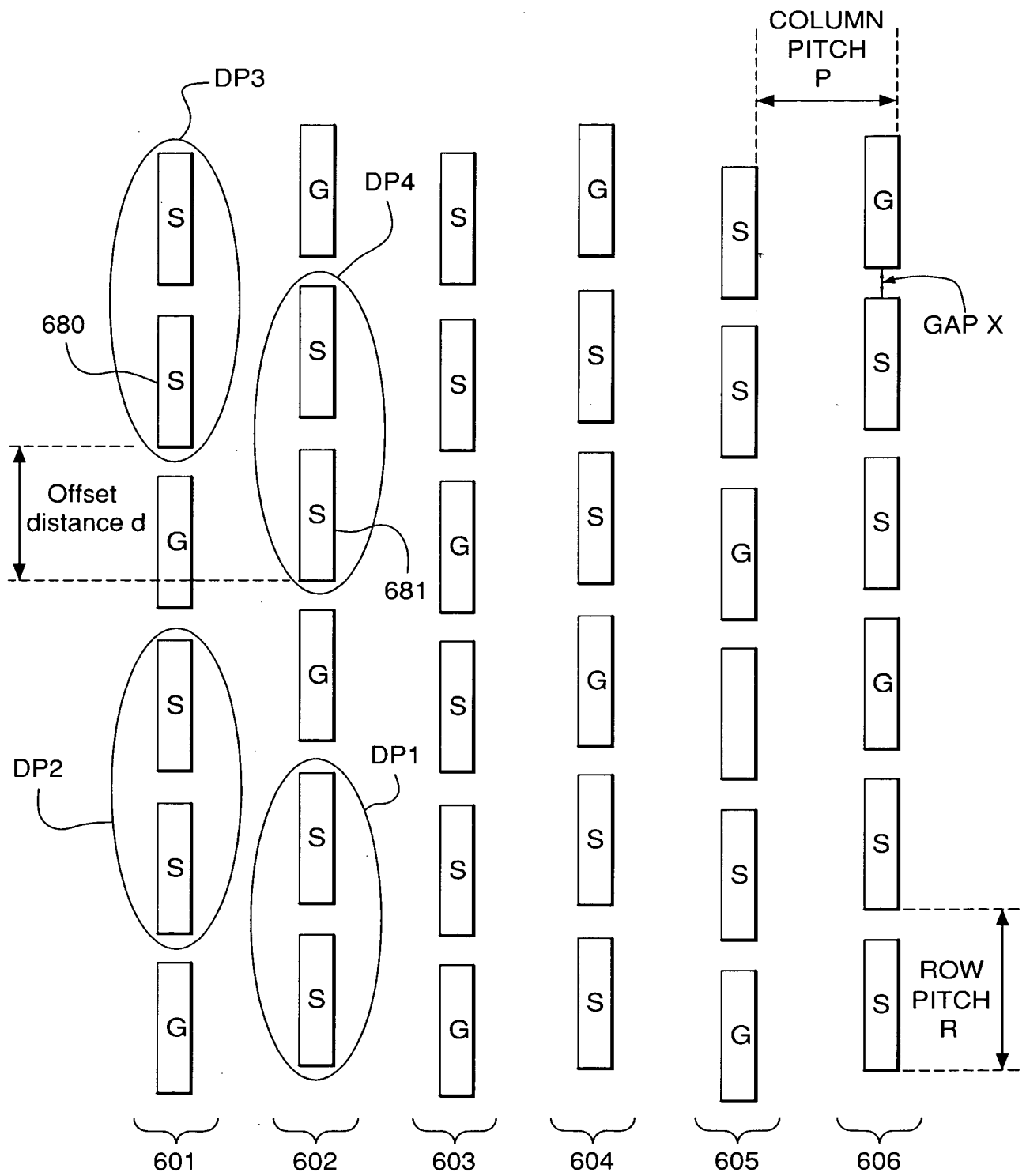| G | S | S1+ | S1- | G | G | } 511 |
S2+	S2-	G	G	S3+	S3-	} 512
G	G	S4+	S4-	G	G	} 513
S5+	S5-	G	G	S6+	S6-	} 514
G	G	S7+	S7-	G	G	} 515
S8+	S8-	G	G	S9+	S9-	} 516

FIG. 5

FIG. 6

FIG. 7

FIG. 8

FIG. 10

FIG. 11

FIG. 9

FIG. 12

FIG. 13A

FIG. 13B

836

850

830

850

832

FIG. 14

FIG. 15

910

905

930

1100

902

900

908

912

FIG. 16A

910

903

912

FIG. 16B

910

1100

905

913
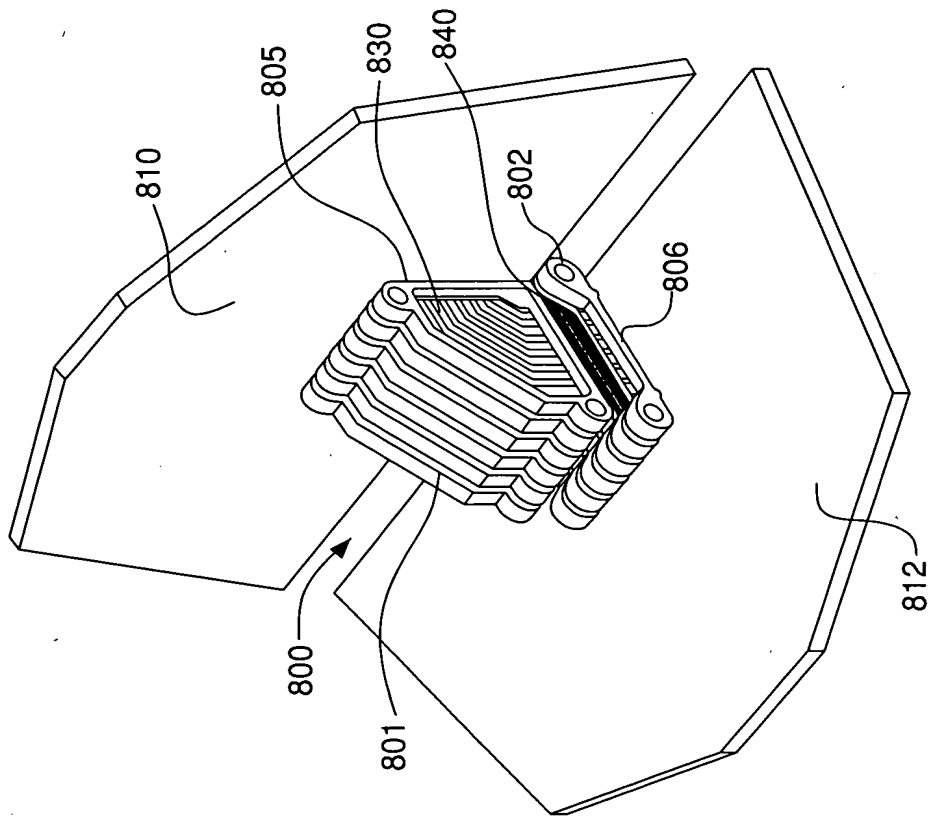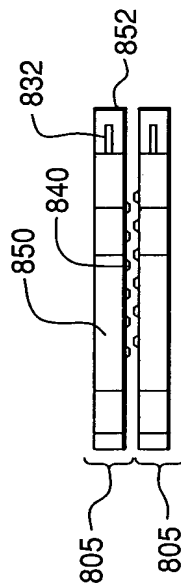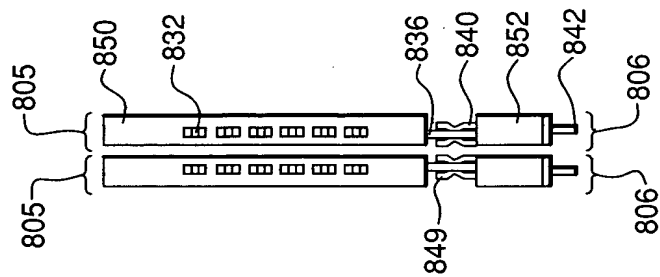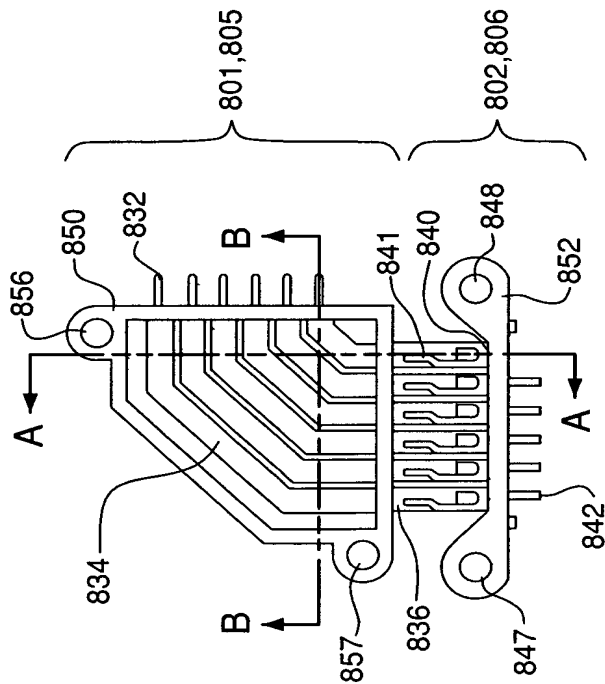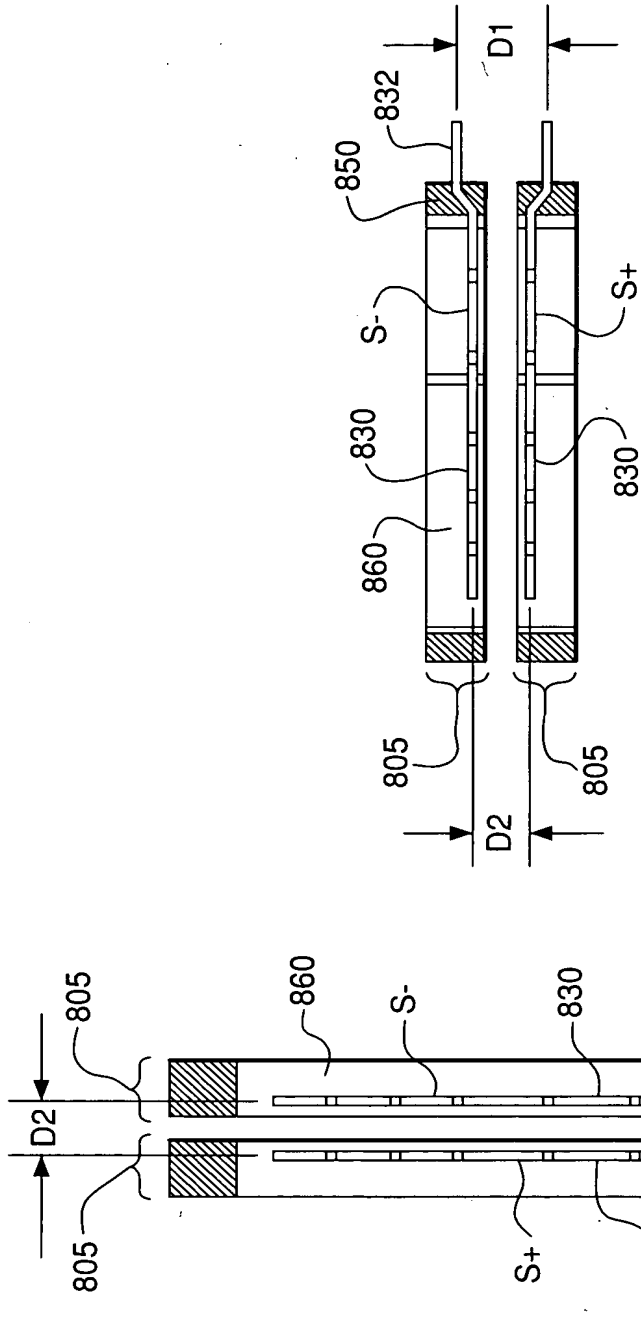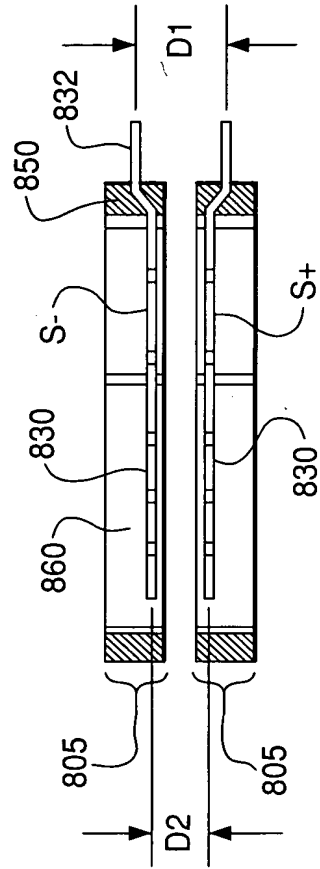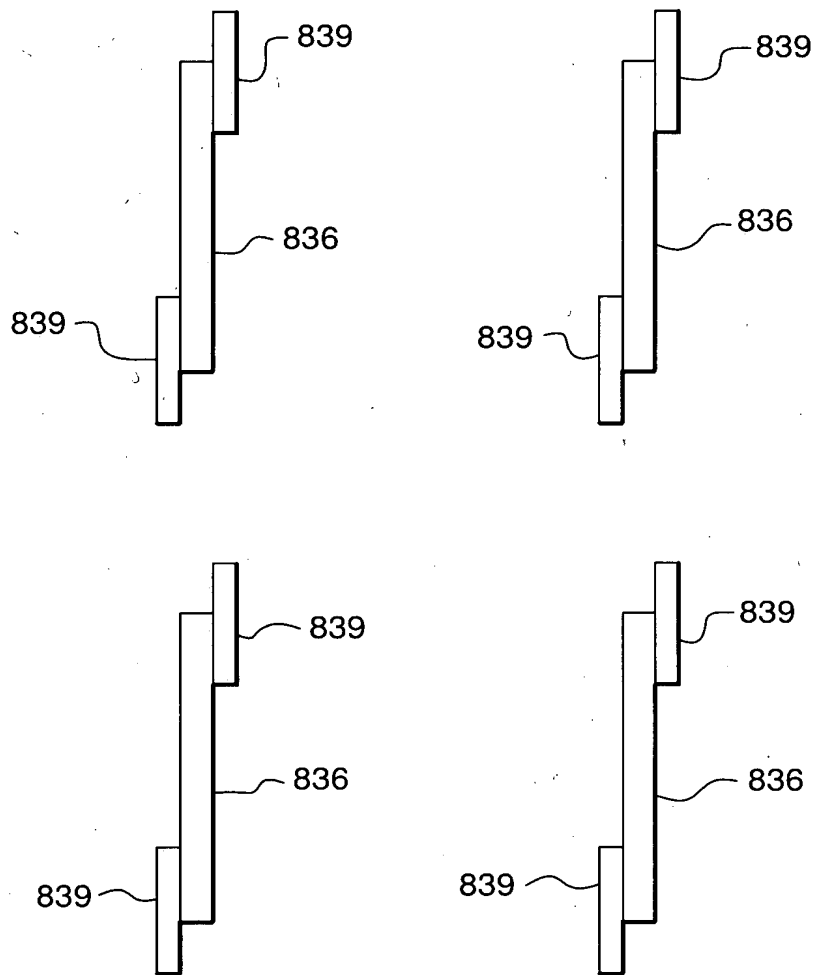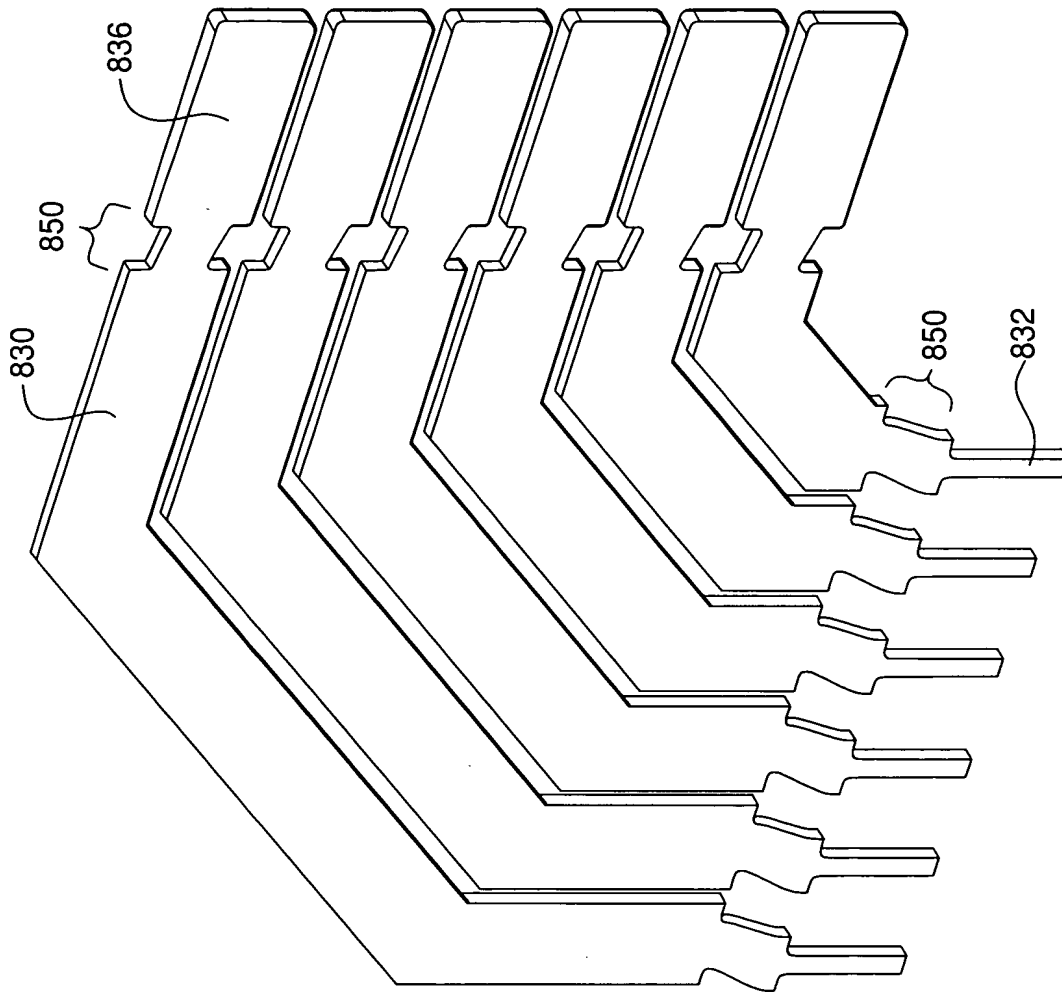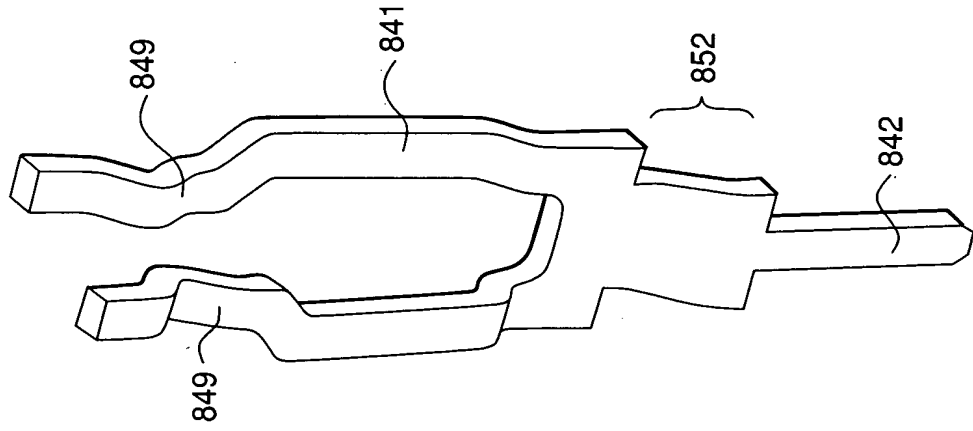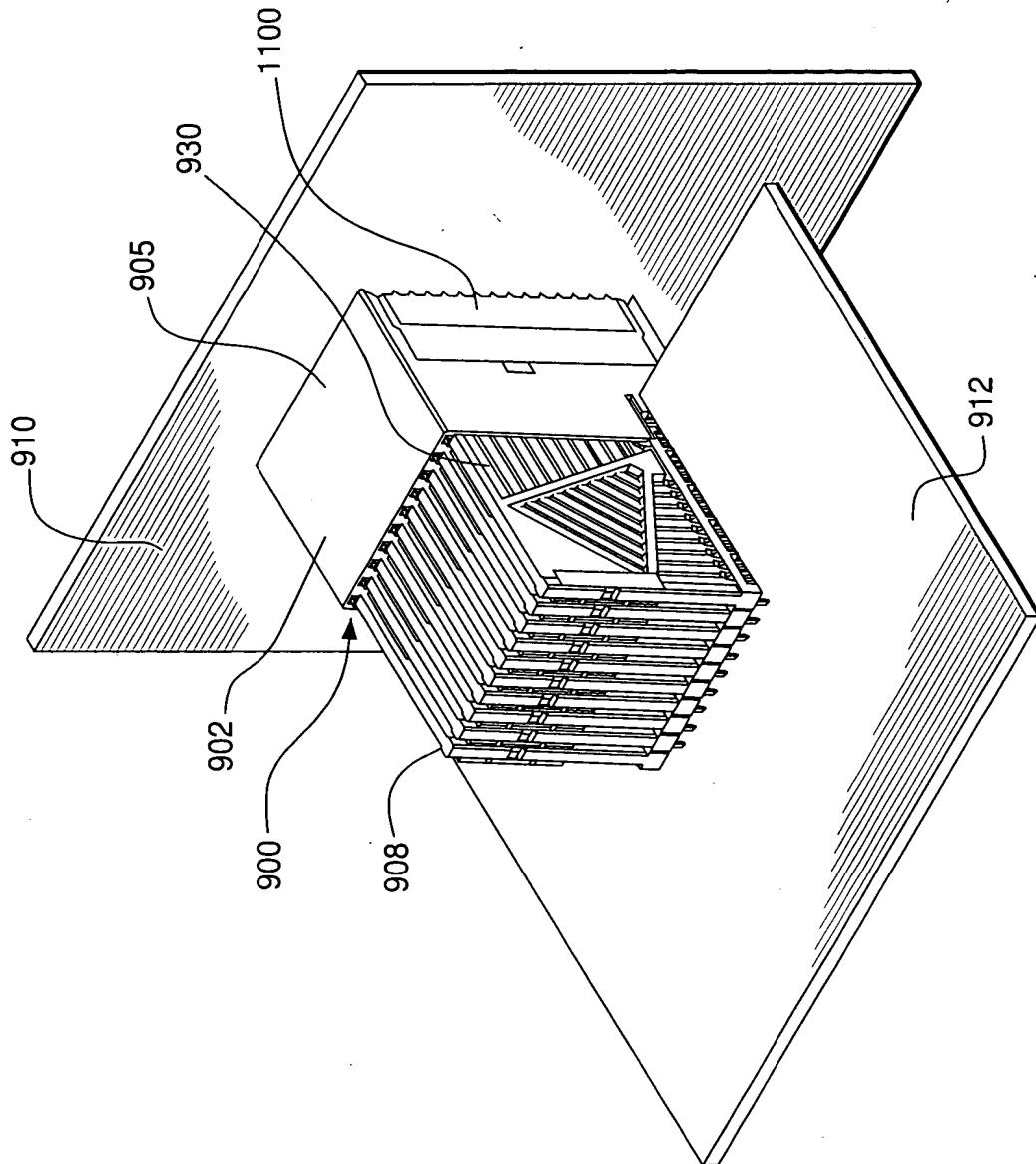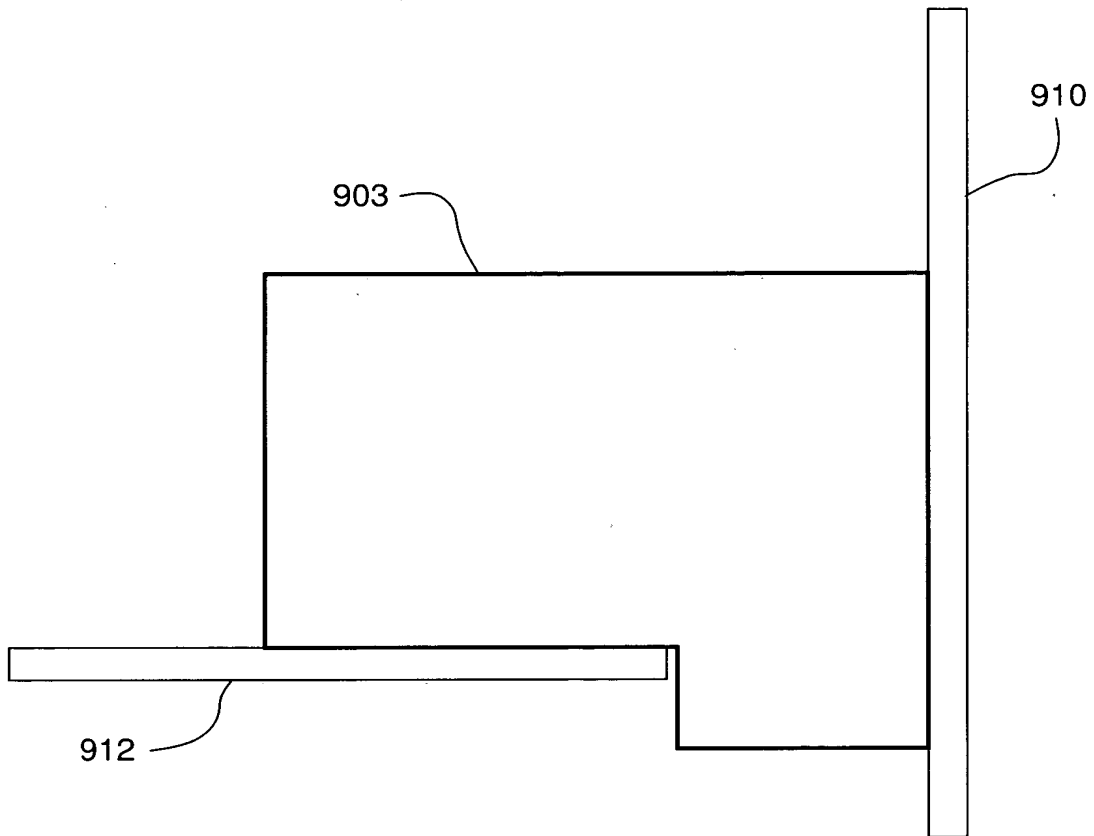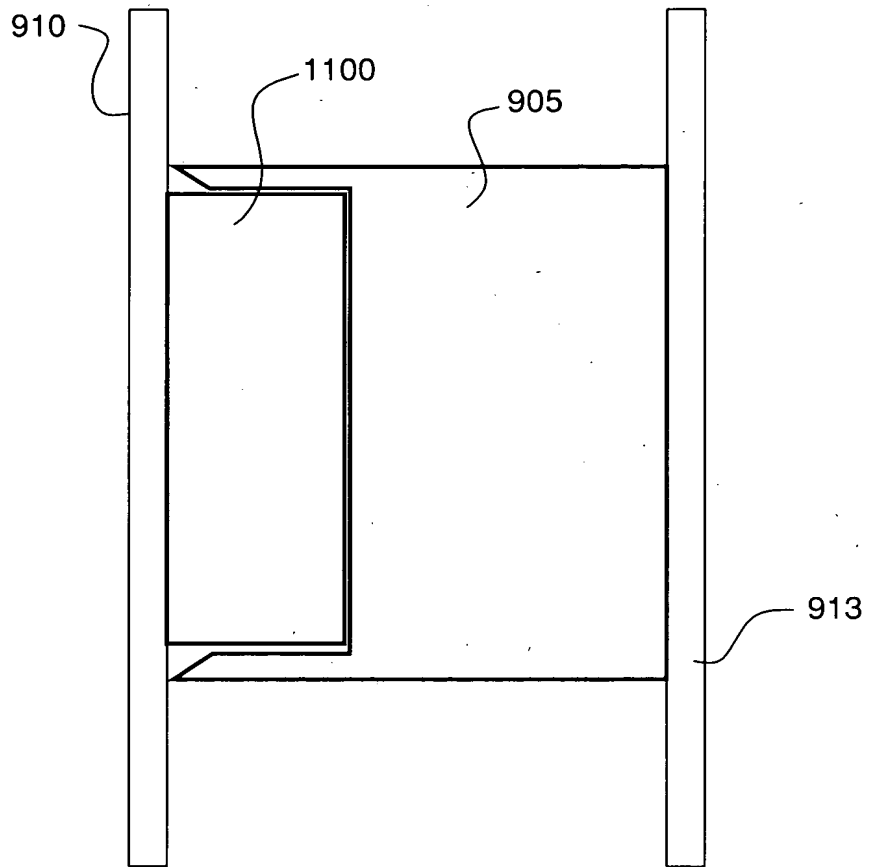
FIG. 16C

FIG. 17

FIG. 18

FIG. 19A
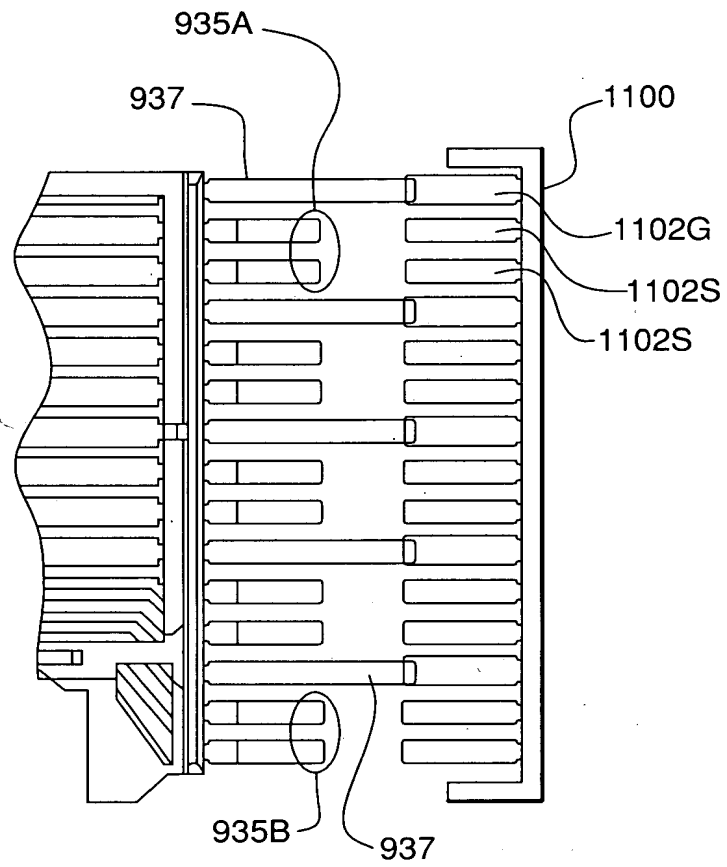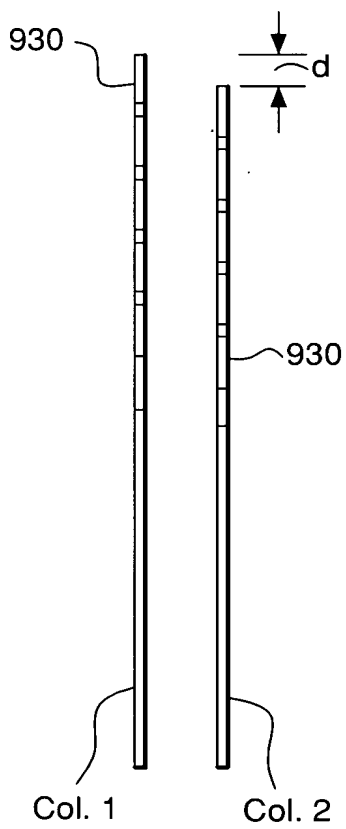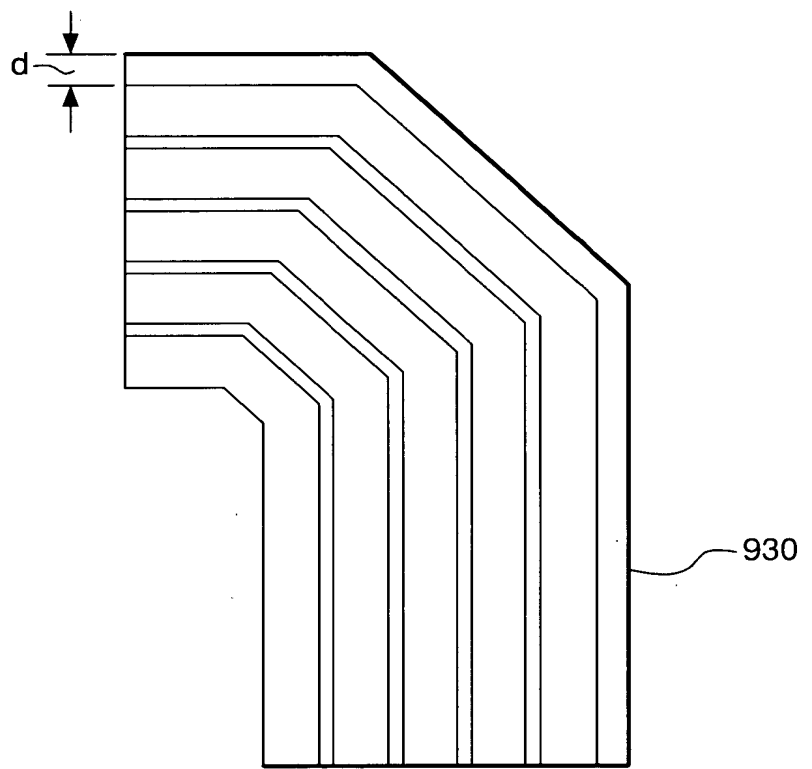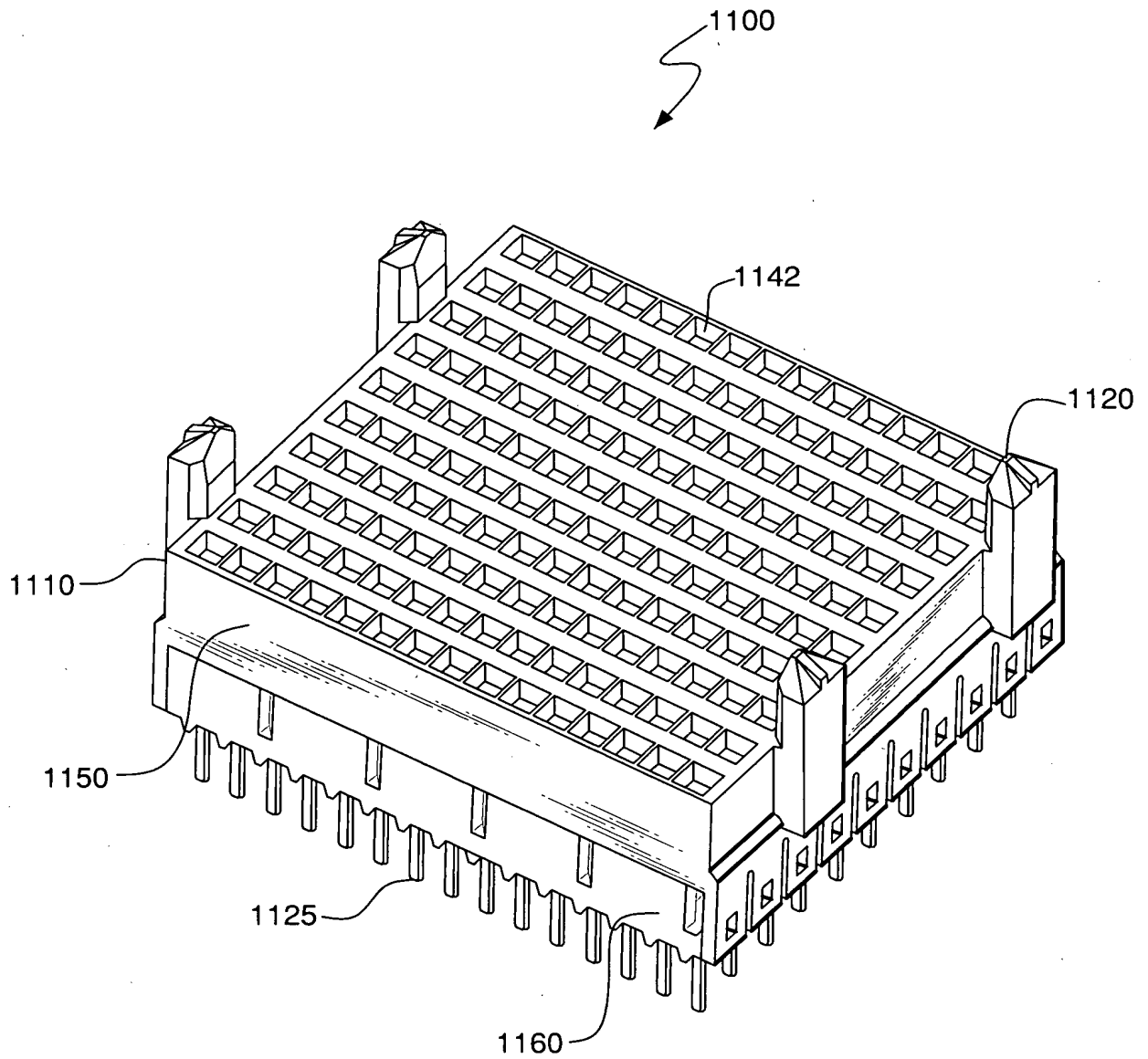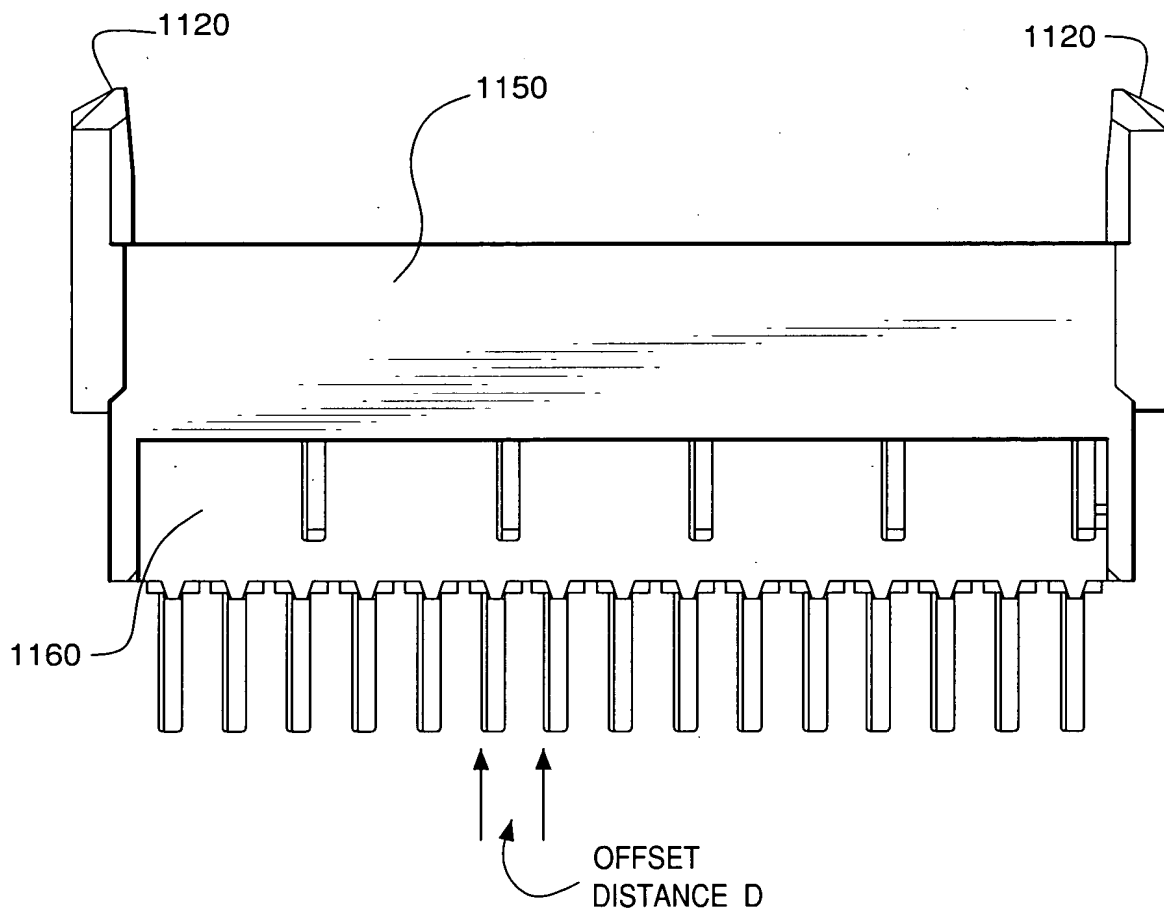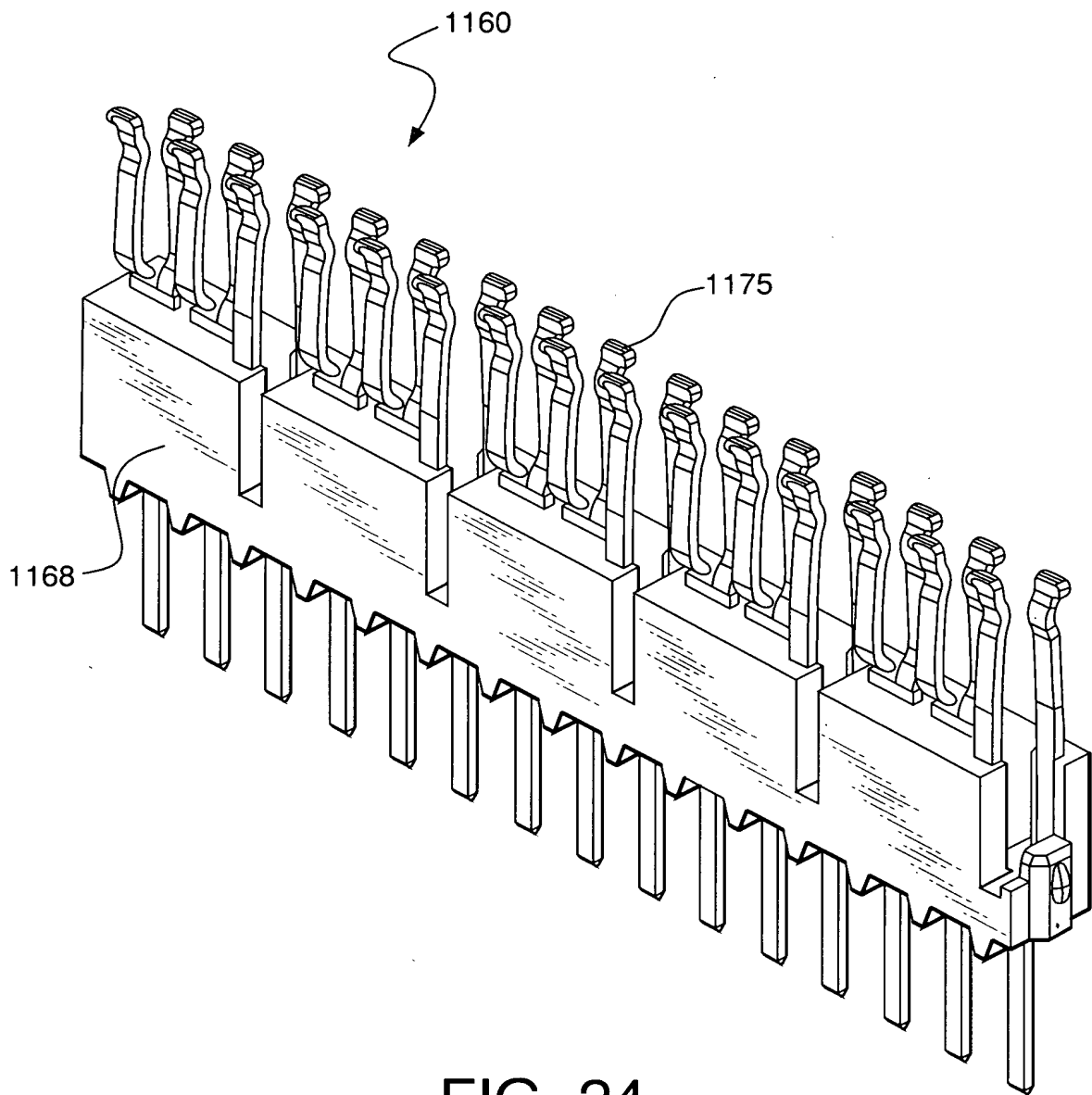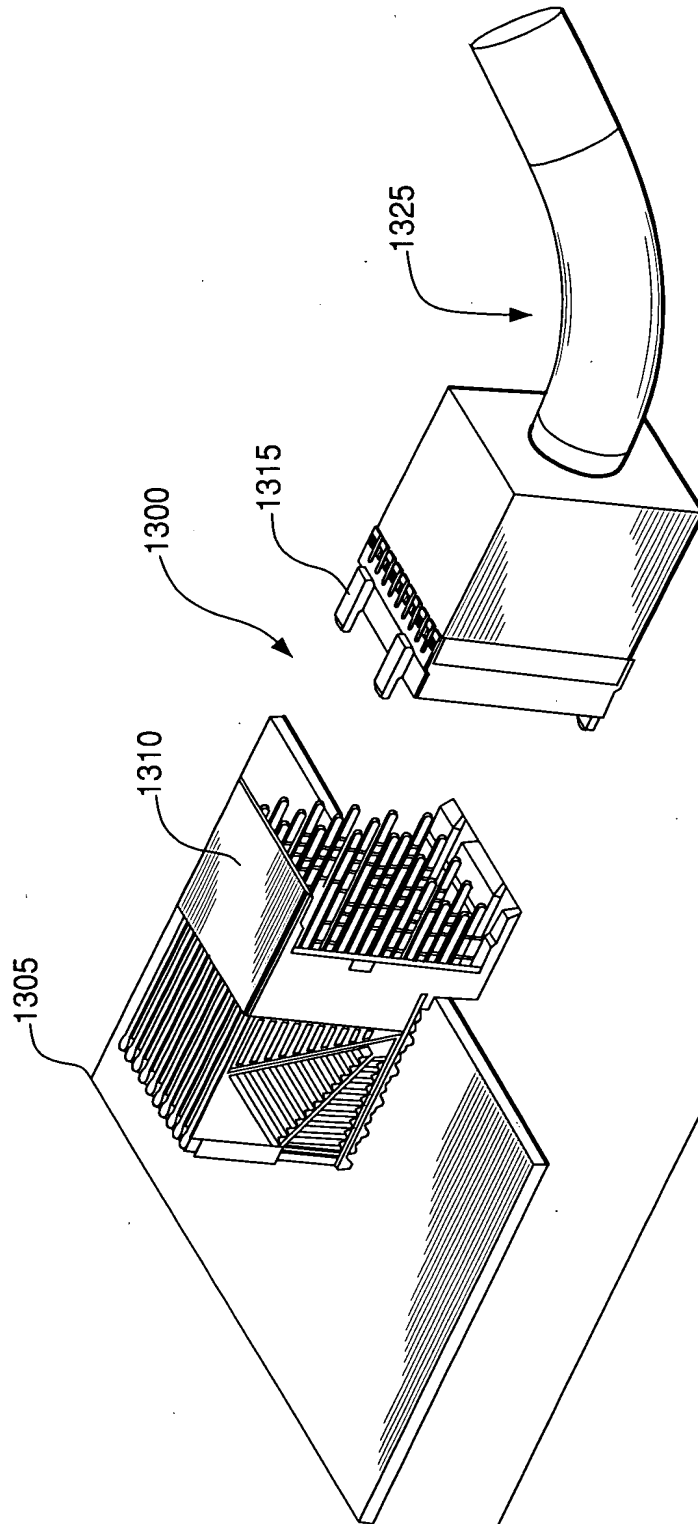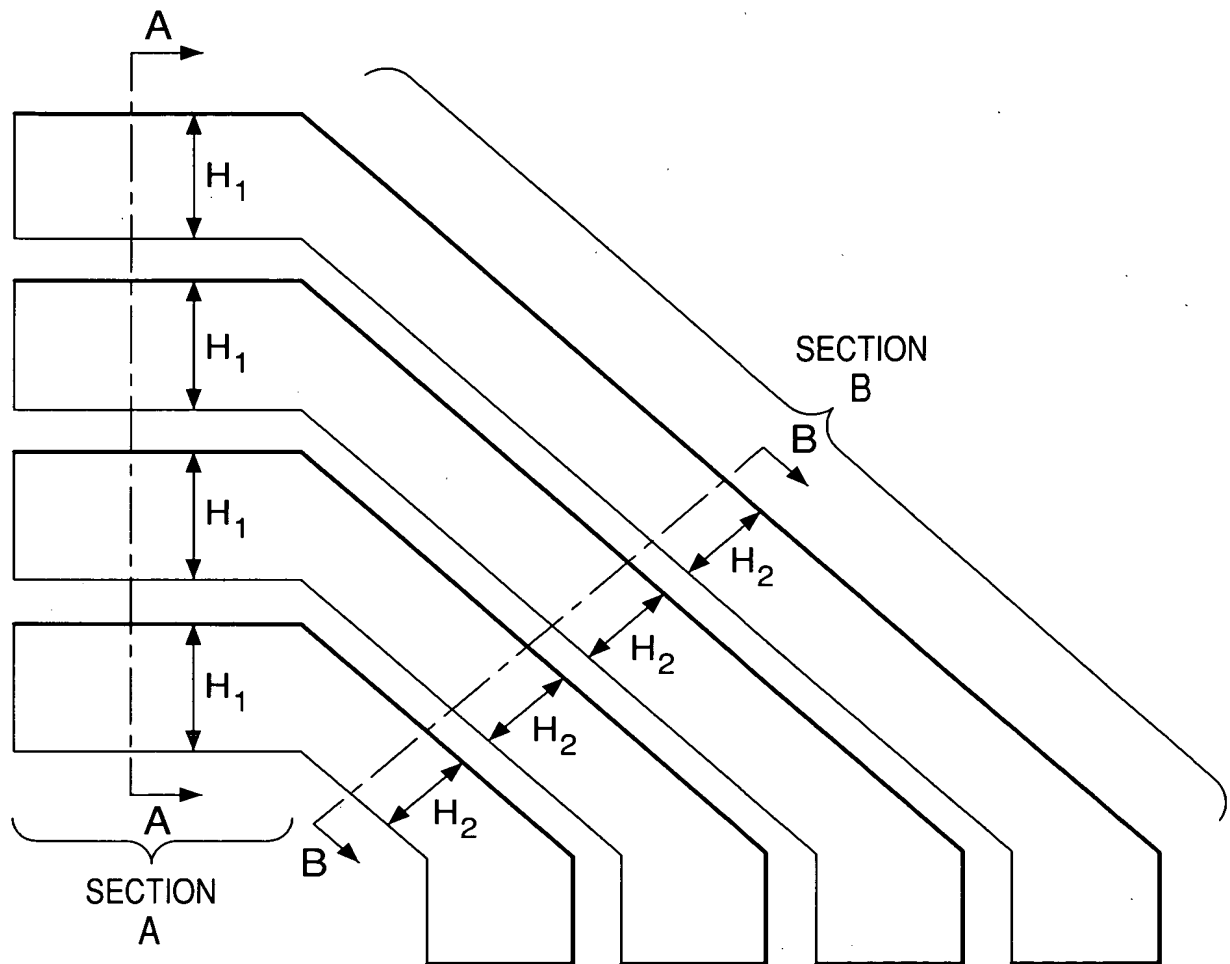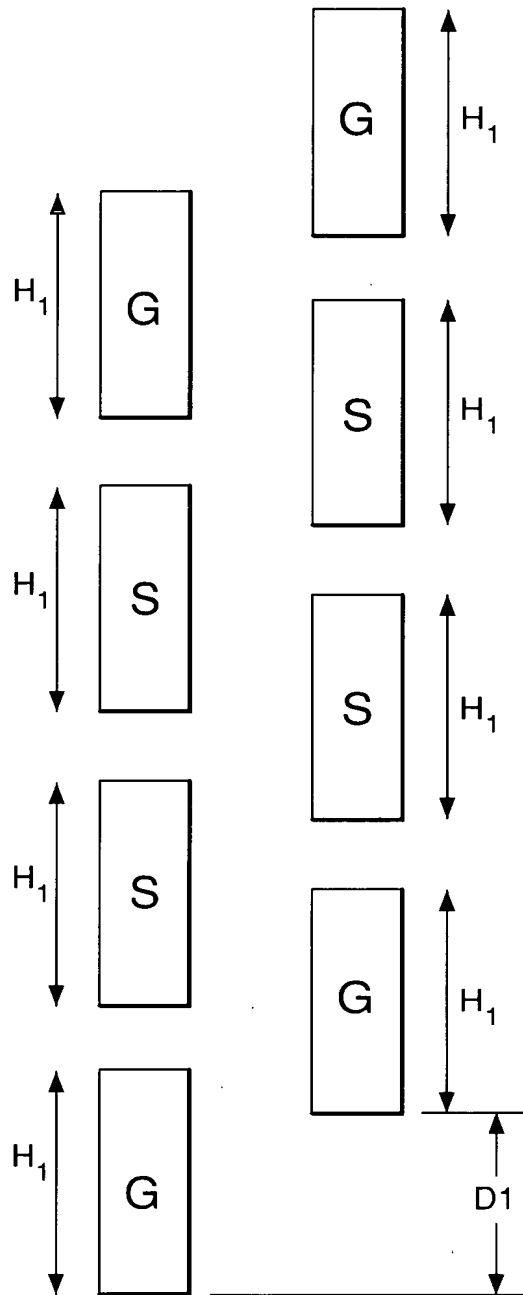
935A

937

1100

1102G

1102S

1102S

935B   937

FIG. 19B

930

930

d

d

930

Col. 1   Col. 2

FIG. 20

FIG. 21

1100

1142

1120

1110

1150

1125

1160

FIG. 22

1120

1150

1120

1160

OFFSET
DISTANCE D

FIG. 23

1160

1175

1168

FIG. 24

1325

1315

1300

1310

1305

FIG. 25

FIG. 26

Section A-A

Section B-B

FIG. 27
FIG. 28

FIG. 29

1100

930

D

D

FIG. 30

1210

1220

1210

1210

FIG. 31

1100'

1175'

1191

1192

1191

1190

1192

FIG. 32

1400 ⎯ INSERT CONDUCTORS
IN DIE BLANK

1410 ⎯ INJECT POLYMER INTO
DIE BLANK

FIG. 33

FIG. 34A

FIG. 34B

FIG. 35A

FIG. 35B

200

220

244
243
242

240B

242

243

244

240A

FIG. 36
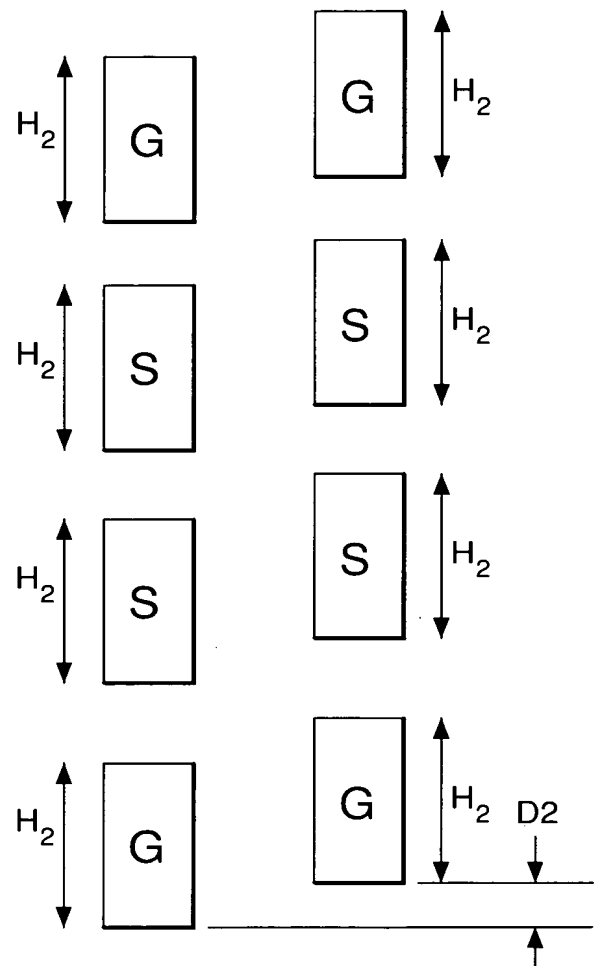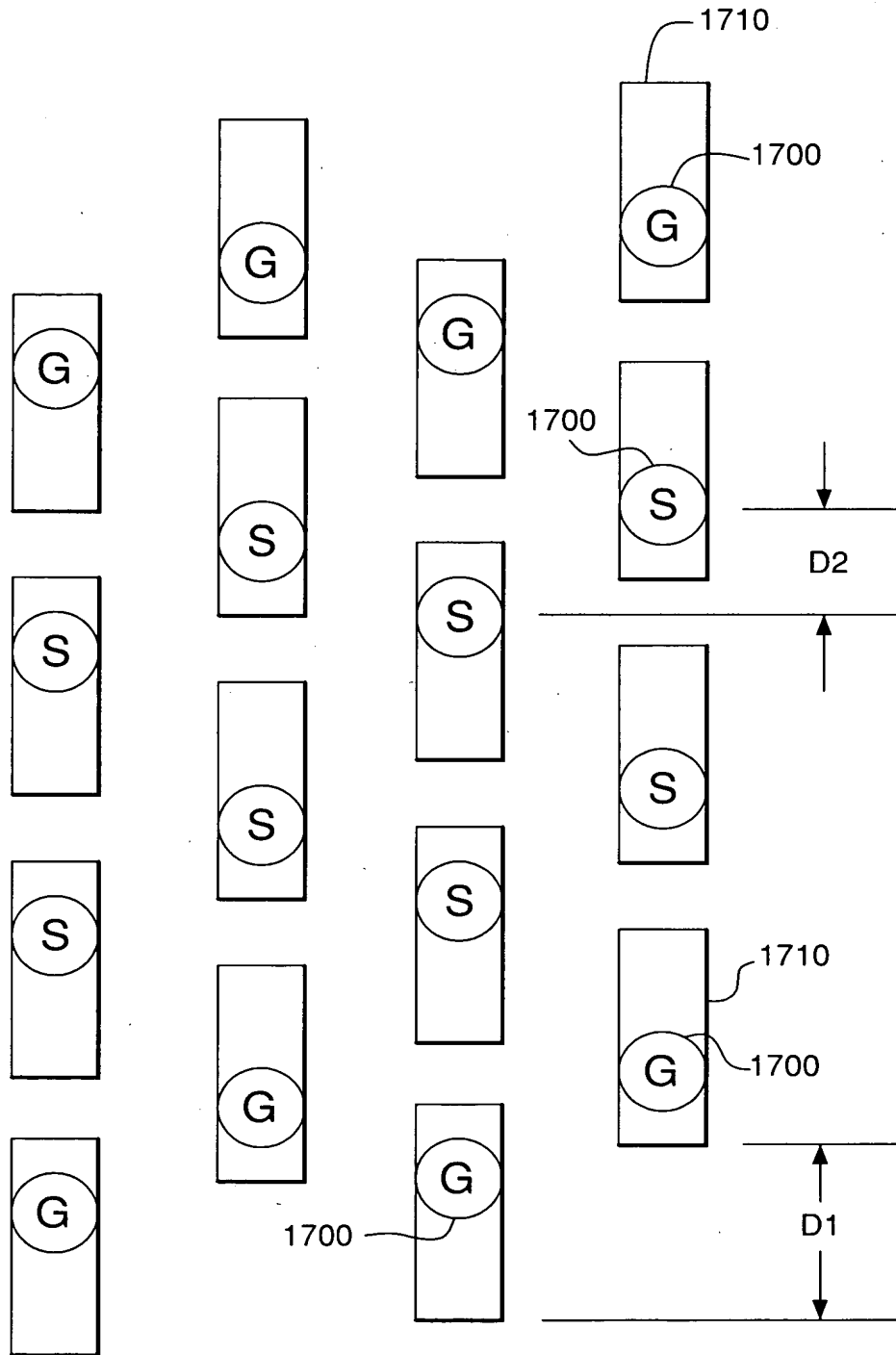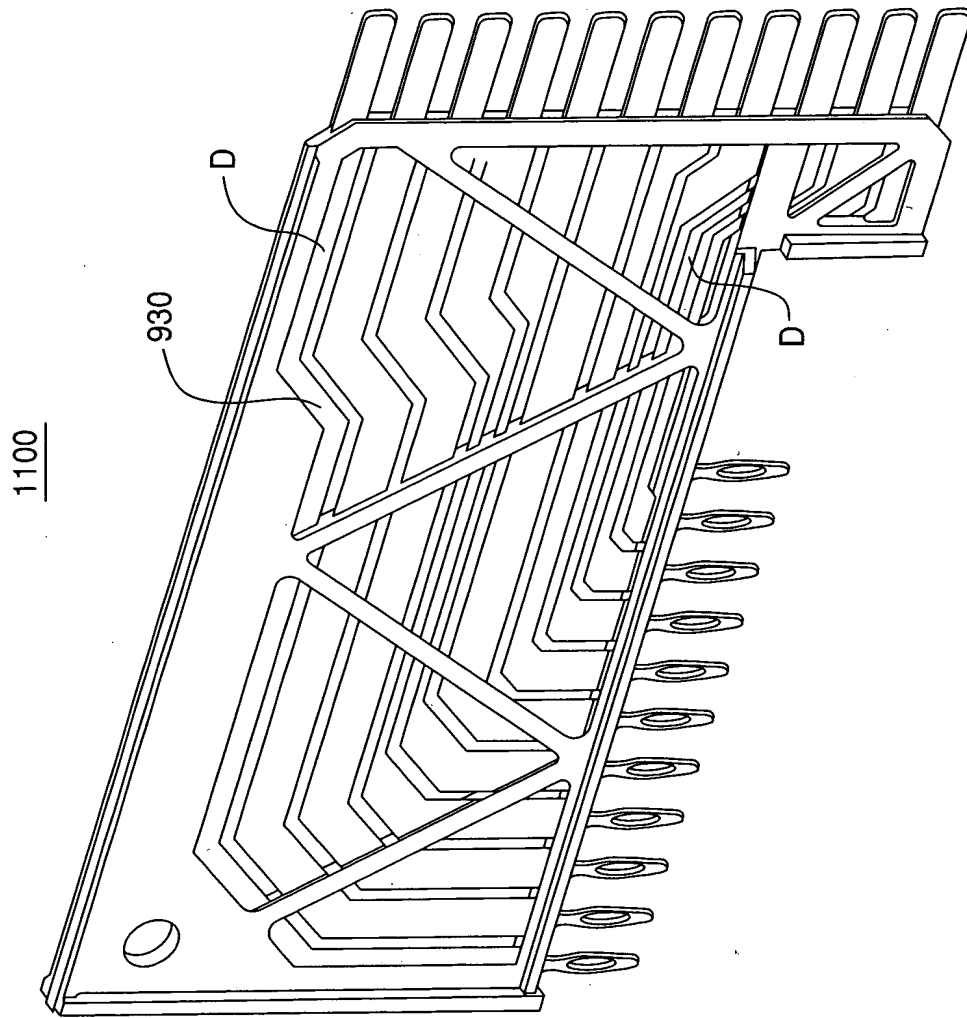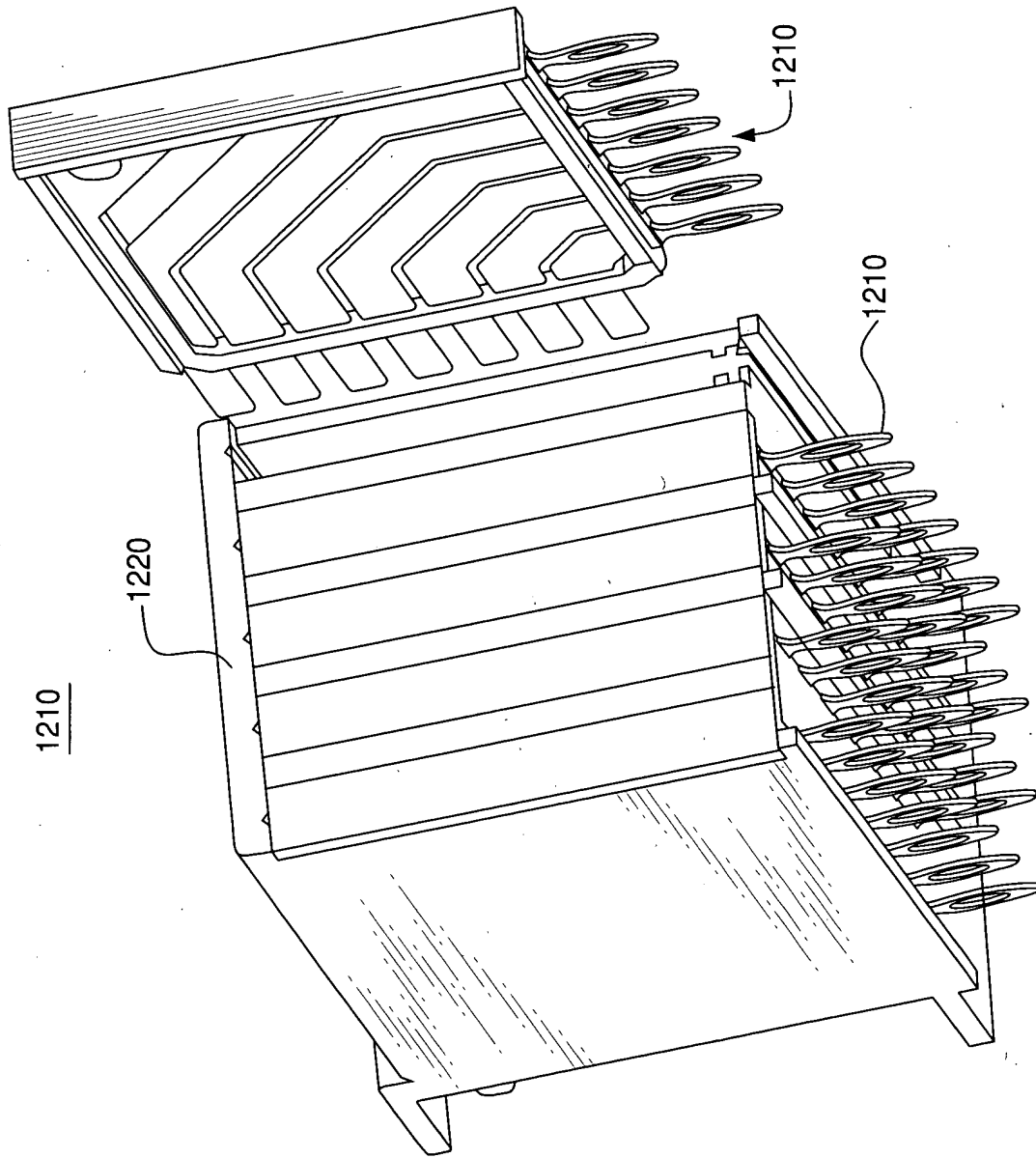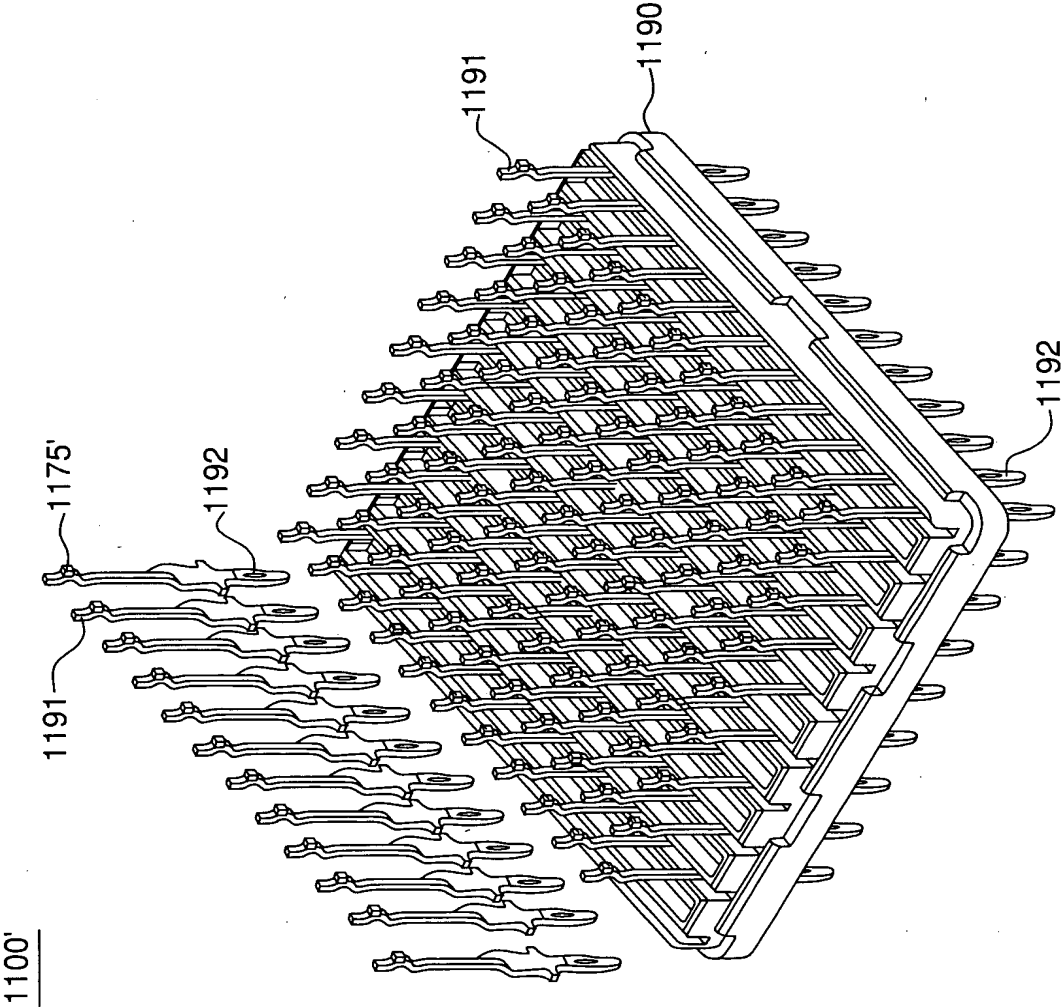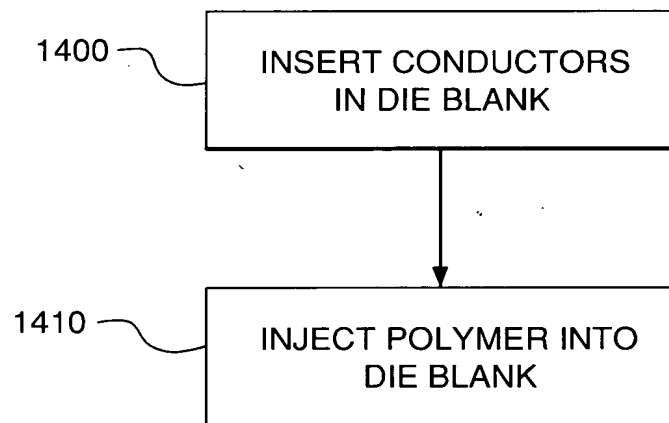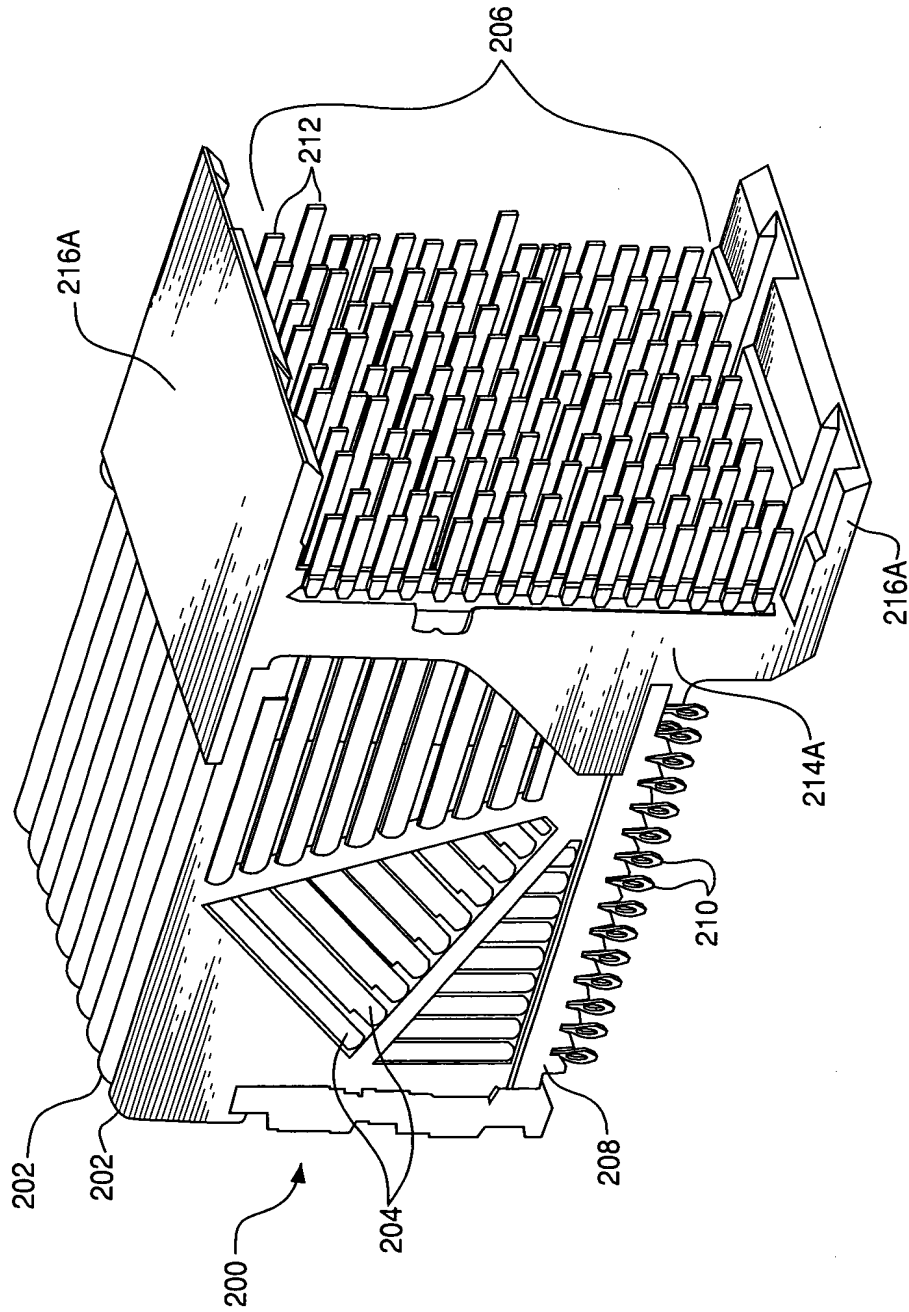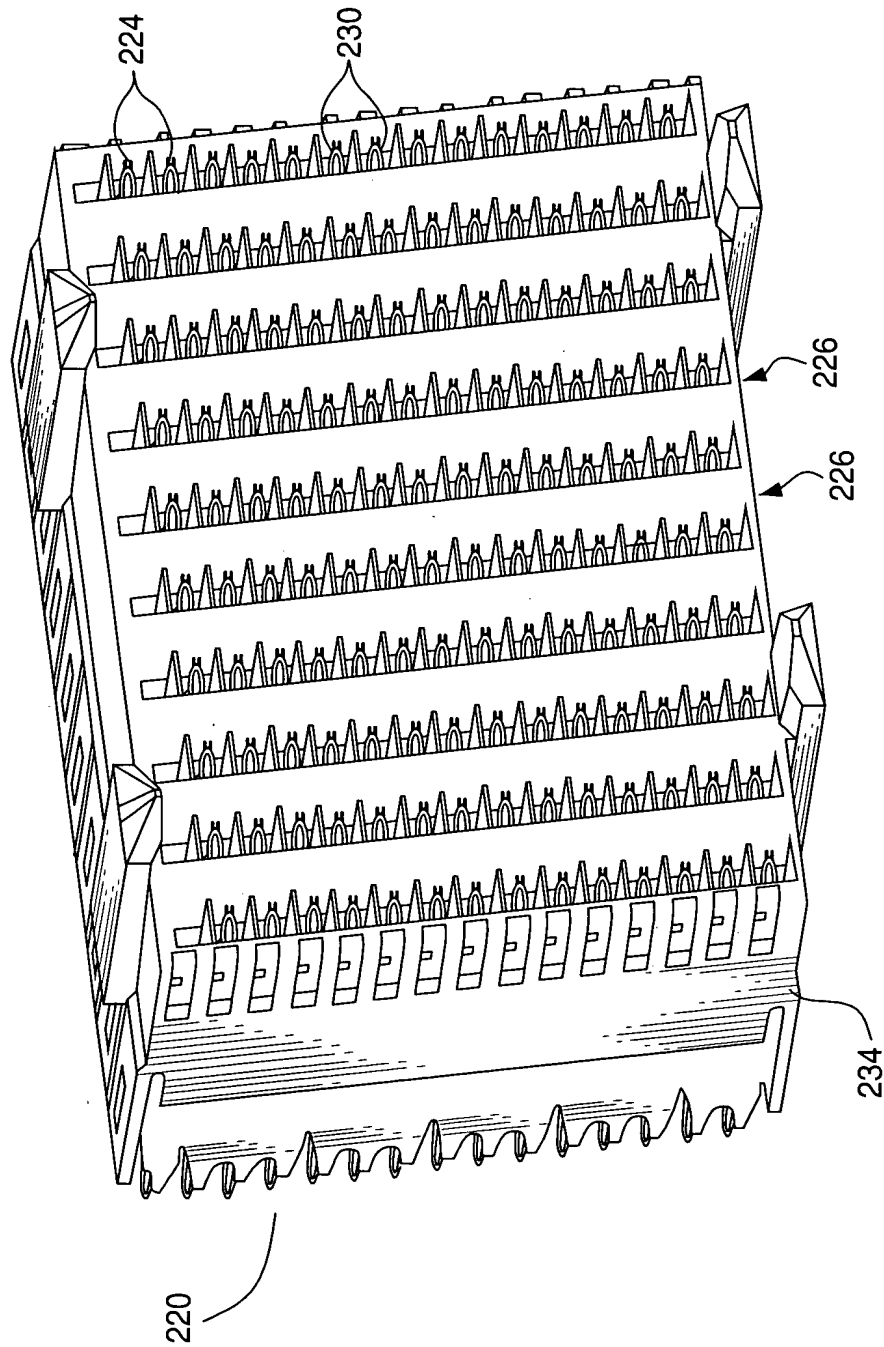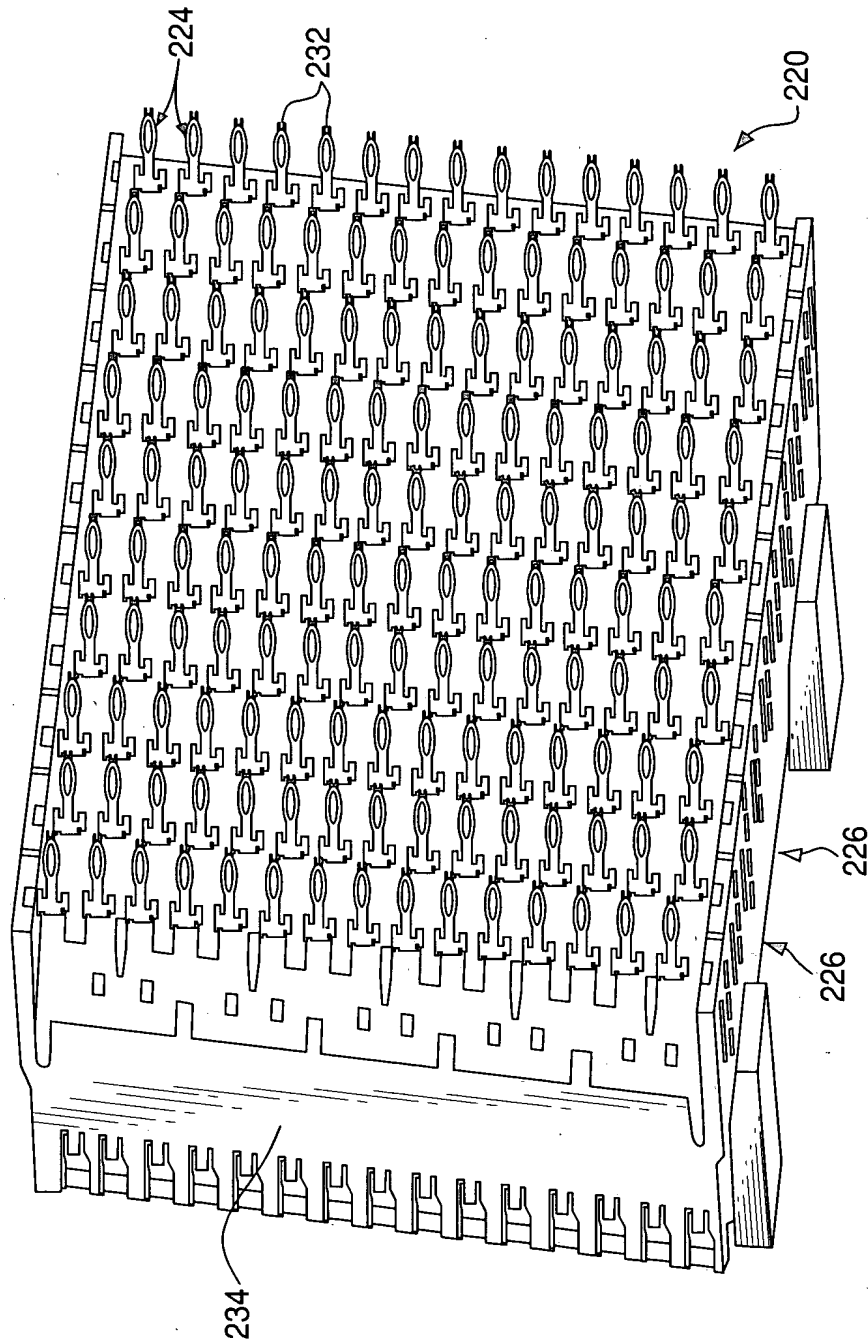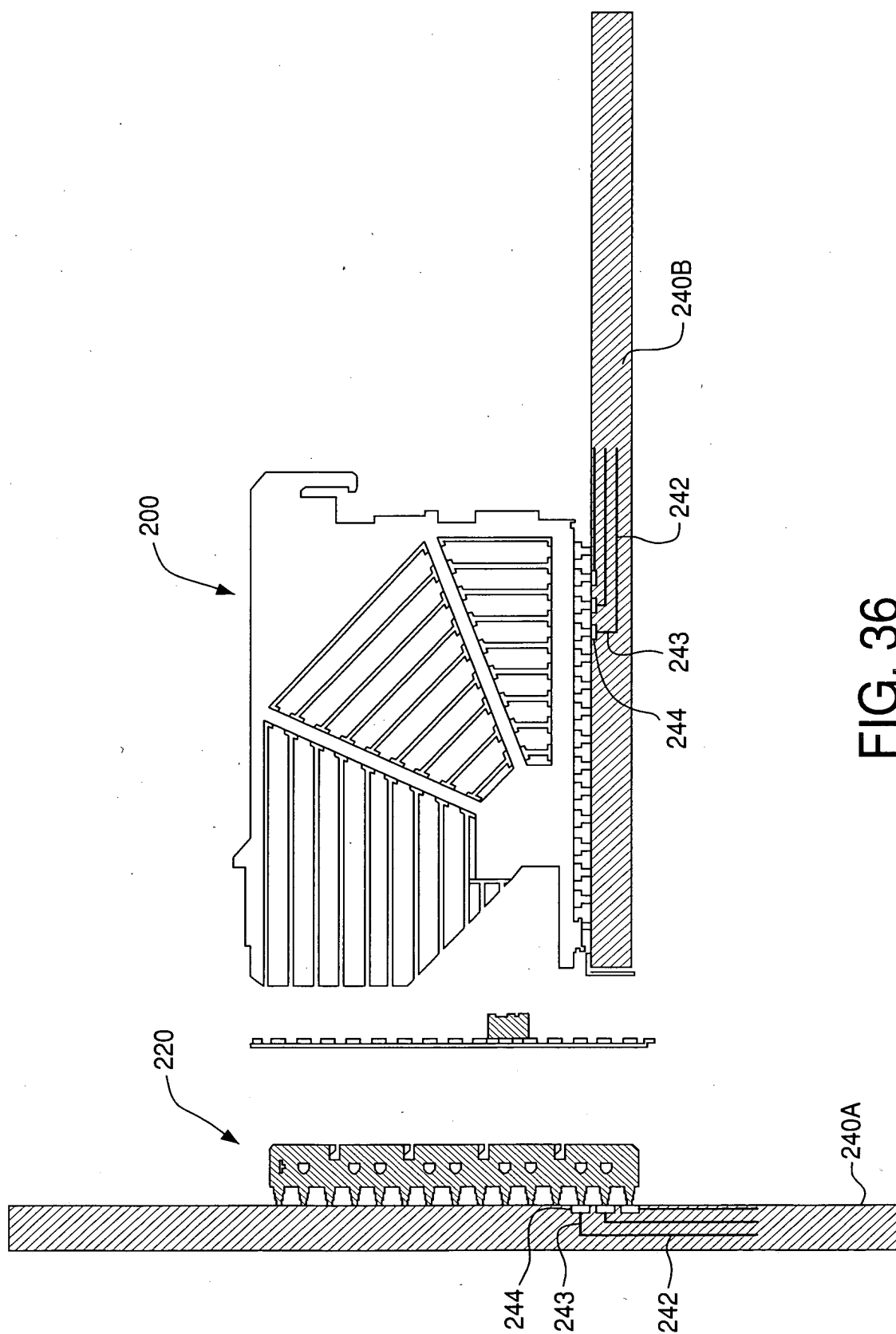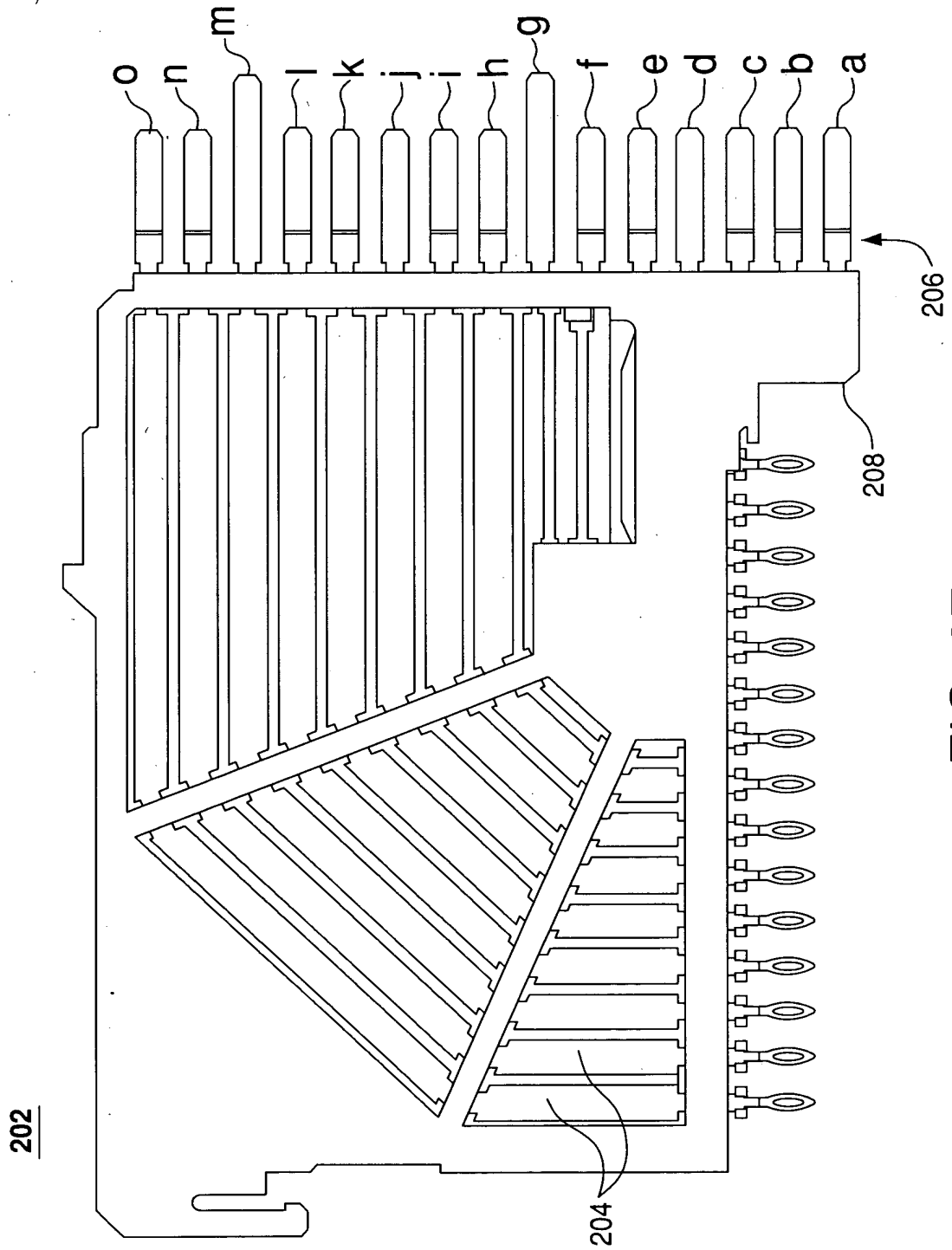
FIG. 37

FIG. 38A   FIG. 38B   FIG. 38C

o n m l k j i h g f e d c b a

206

208

204

202

FIG. 39

o [G]
n [S]
m [S]
l [G]
k [S]
j [S]
i [G]
h [S]
g [S]
f [G]
e [S]
d [S]
c [G]
b [S]
a [S]

o [S]
n [G]
m [S]
l [G]
k [S]
j [G]
i [S]
h [G]
g [S]
f [G]
e [S]
d [G]
c [S]
b [G]
a [S]

o [G]
n [S]
m [S]
l [G]
k [S]
j [S]
i [G]
h [S]
g [S]
f [G]
e [S]
d [G]
c [S]
b [G]
a [S]

FIG. 40A   FIG. 40B   FIG. 40C

T

GND ☐ ‖W
   〜 ⇕ GW
1N ☐ ‖W

1M ☐

GND ☐

1K ☐

1J ☐

GND ☐

1H ☐

1G ☐

GND ☐

1E ☐

1D ☐

GND ☐

1B ☐

1A ☐

I 1

246A

T

2O ☐ ‖
       ‖C
2N ☐ ‖

GND ☐

2L ☐

2K ☐

GND ☐

2I ☐

2H ☐

GND ☐

2F ☐

2E ☐

GND ☐

2C ☐

2B ☐

GND ☐

I 2

IS

246B
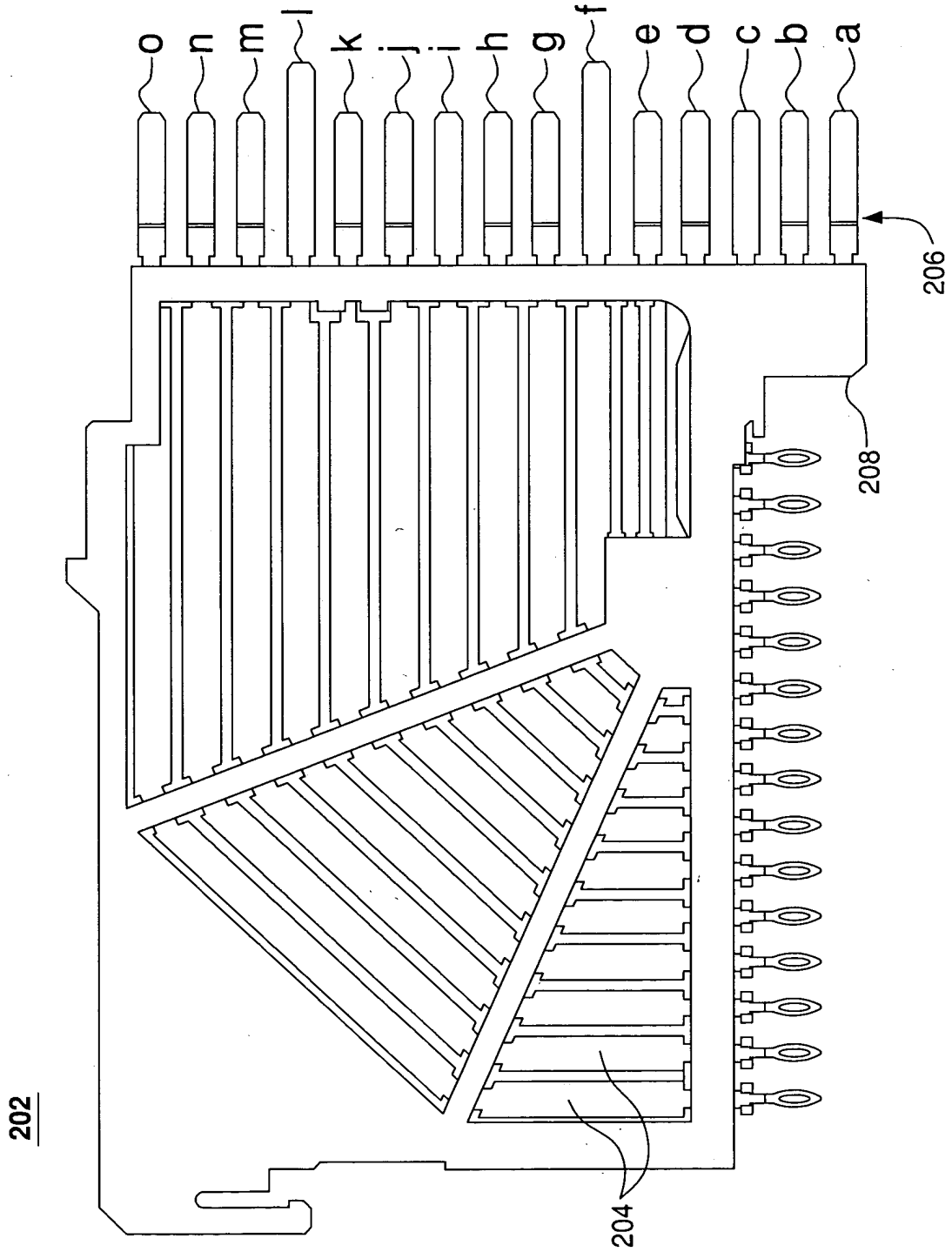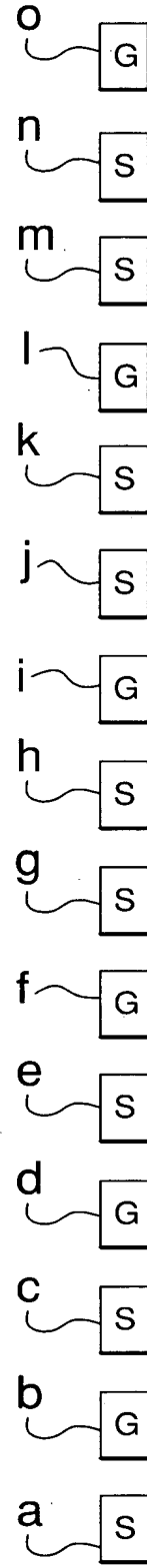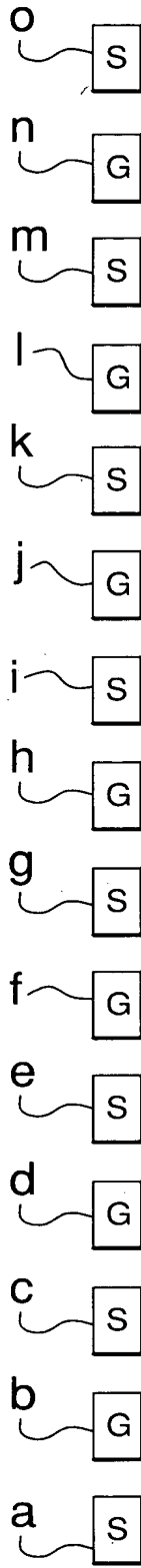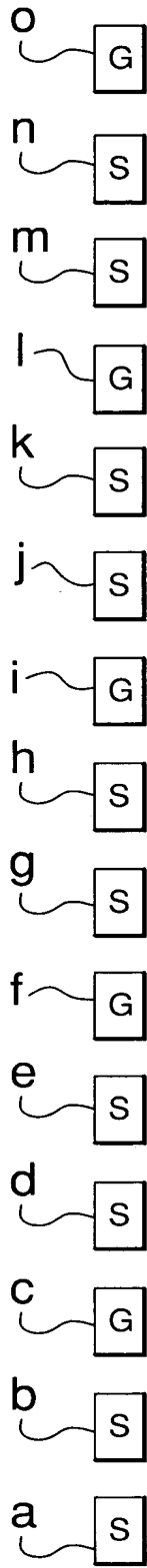
FIG. 41

IMPEDANCE

Differential AirMAX VS

Rise Time =40ps (10-90%)

——	AB
——	BC
———	DE
———	EF
——	GH
——	HI
—·—	JK
———	KL
——	MN
—·—	NO

TEST BOARDS

HEADER VIAS

CONNECTOR

RECEPTACLE VIAS

TEST

Impedance (ohms)

110.00
105.00
100.00
95.00
90.00
85.00
80.00
75.00
70.00

200 300 400 500 600 700 800 900 1000

time (100ps/div)
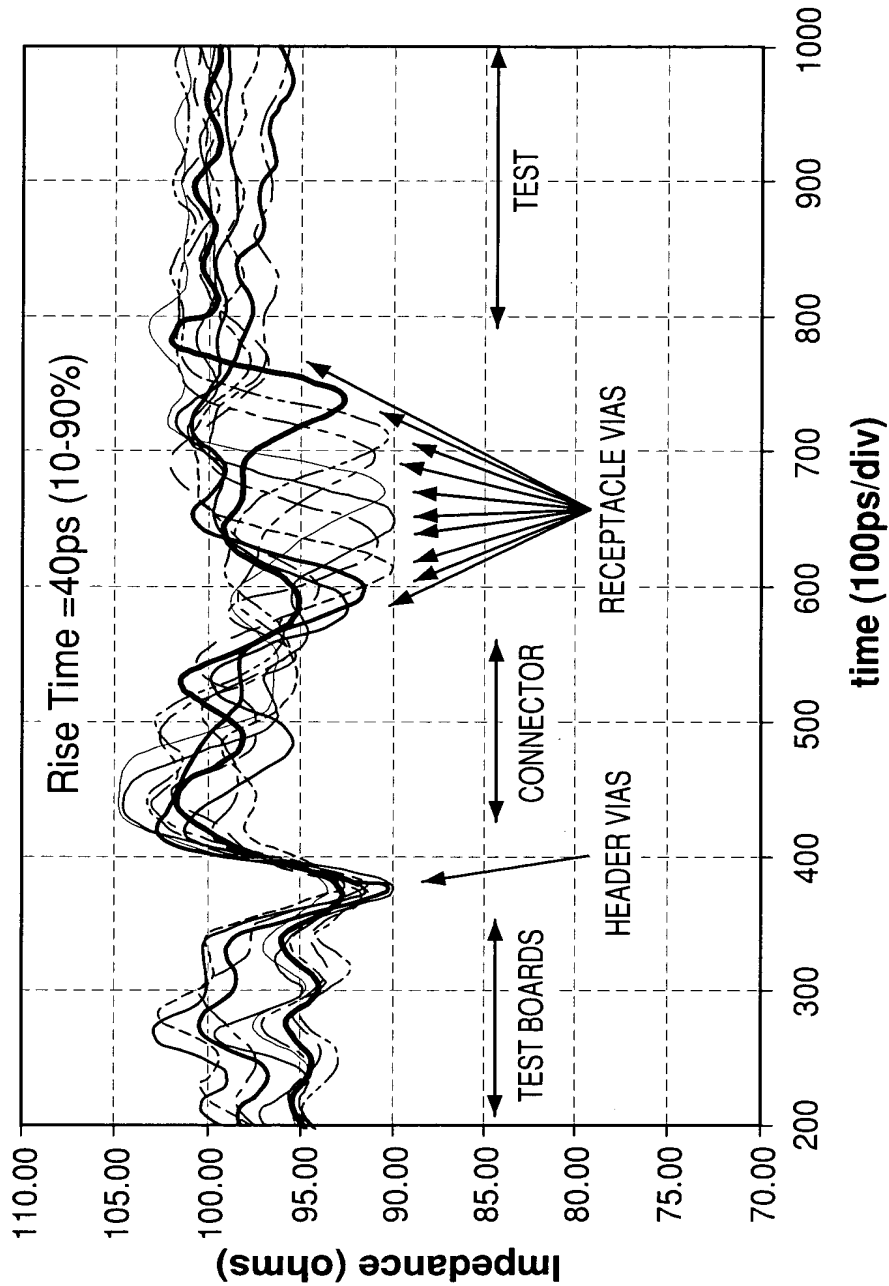
FIG. 42A

INSERTION LOSS

Differential AirMax VS
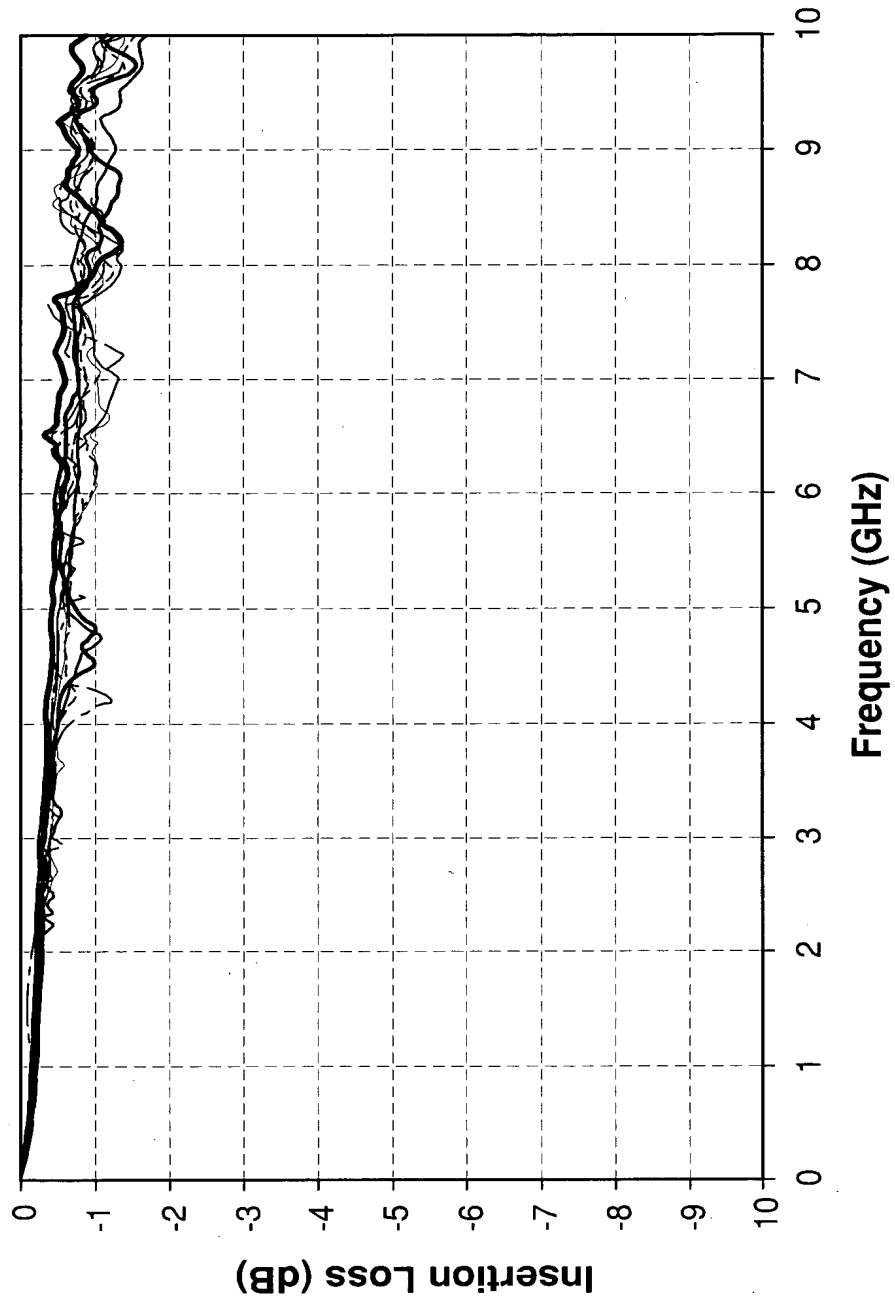
FIG. 42B

CROSSTALK

Worst-Case Multi-Active Near-End Crosstalk

	AB	BC	DE	EF	GH	HI	JK	KL	MN	NO
40ps (10-90%)	1.9	2.4	2.4	2.3	2.5	2.2	2.4	2.1	2.6	1.7
100ps (10-90%)	1.4	1.8	1.7	1.8	1.9	1.7	2.0	1.7	1.8	1.0

FIG. 42C

Worst-Case Multi-Active Far-End Crosstalk

	AB	BC	DE	EF	GH	HI	JK	KL	MN	NO
40ps (10-90%)	2.7	1.8	5.0	3.4	4.2	3.2	4.1	2.9	2.4	1.1
100ps (10-90%)	1.3	0.8	2.2	1.5	1.9	1.4	1.8	1.3	1.1	0.5

FIG. 42D

1O	GND
GND	2N
1M	GND
GND	2L
1K	GND
GND	2J
1I	GND
GND	2H
1G	GND
GND	2F
1E	GND
GND	2D
1C	GND
GND	2B
1A	GND

246A 246B
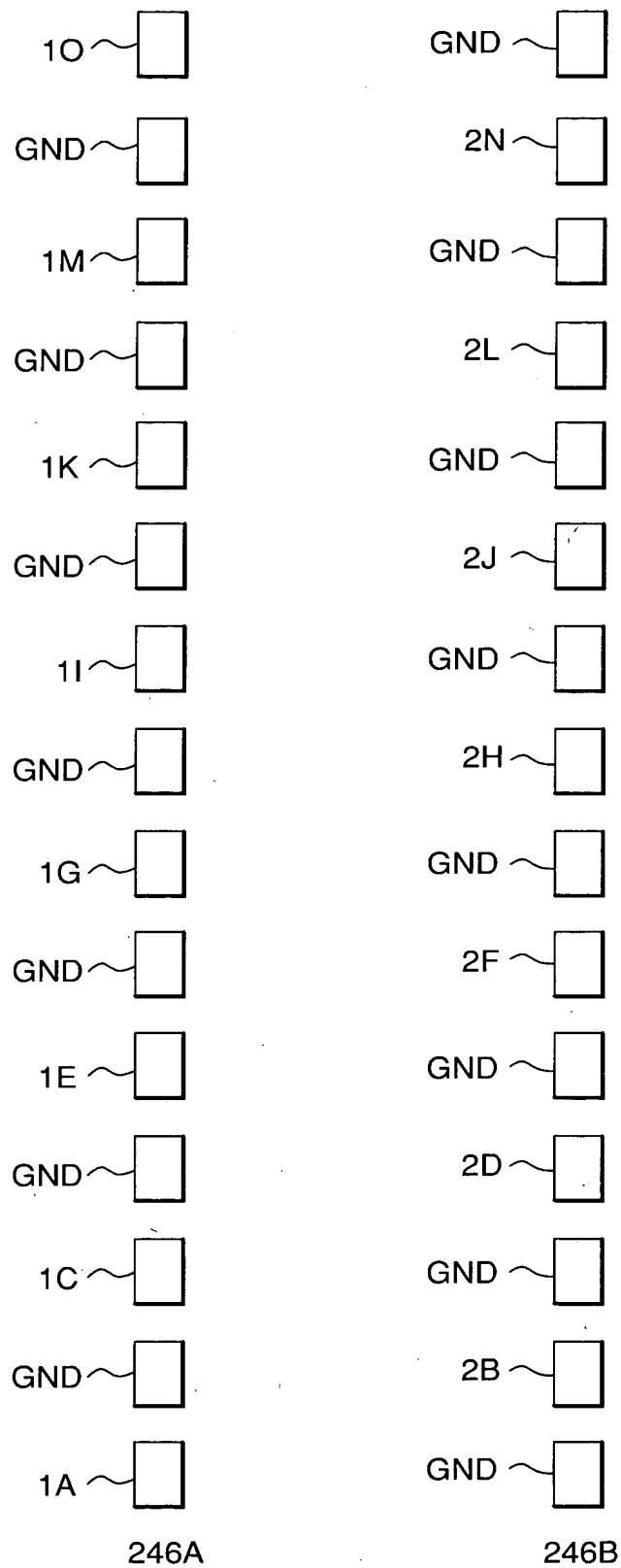
FIG.43

IMPEDANCE

Single-Ended AirMax VS
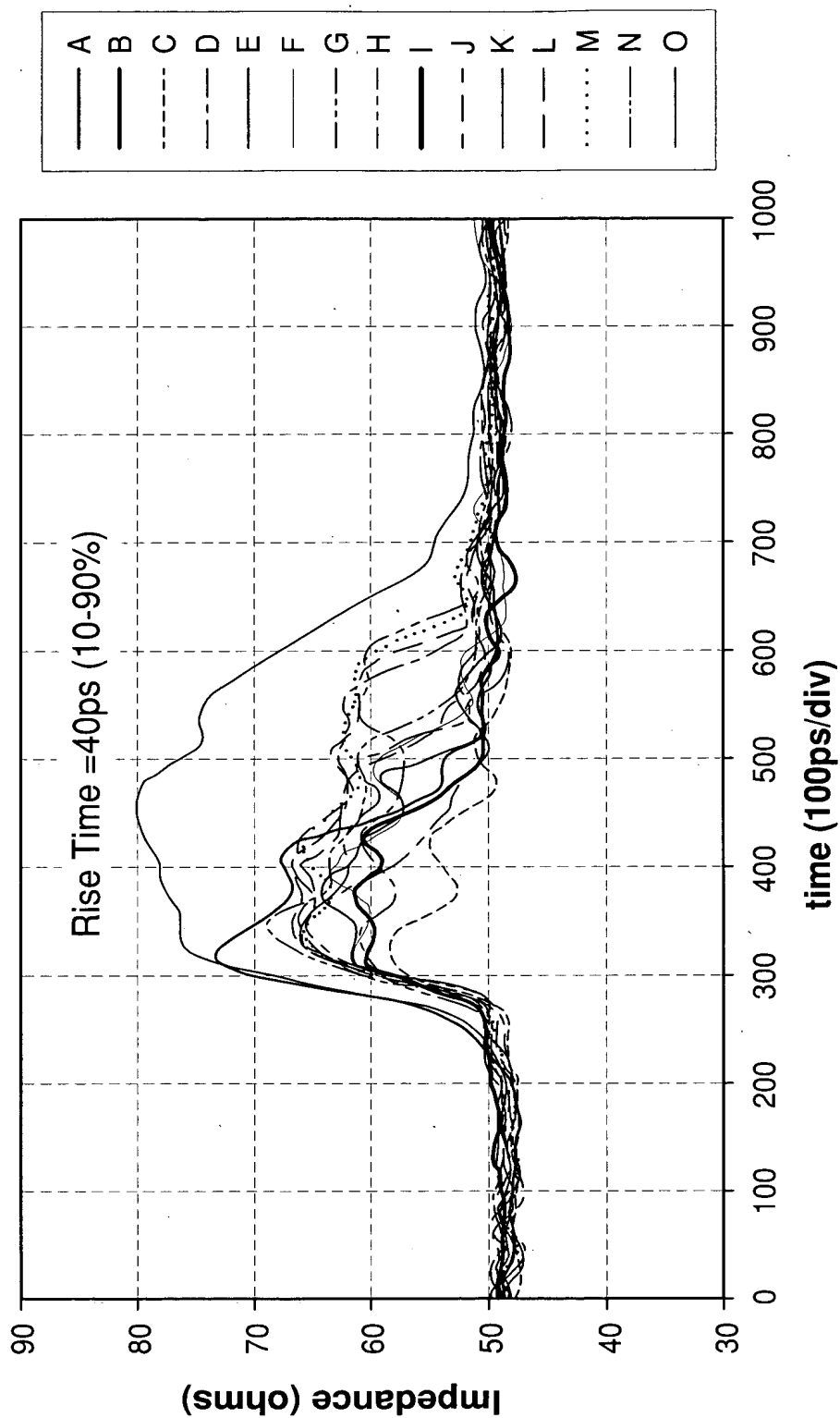
FIG. 44A

IMPEDANCE

Single-Ended AirMax VS
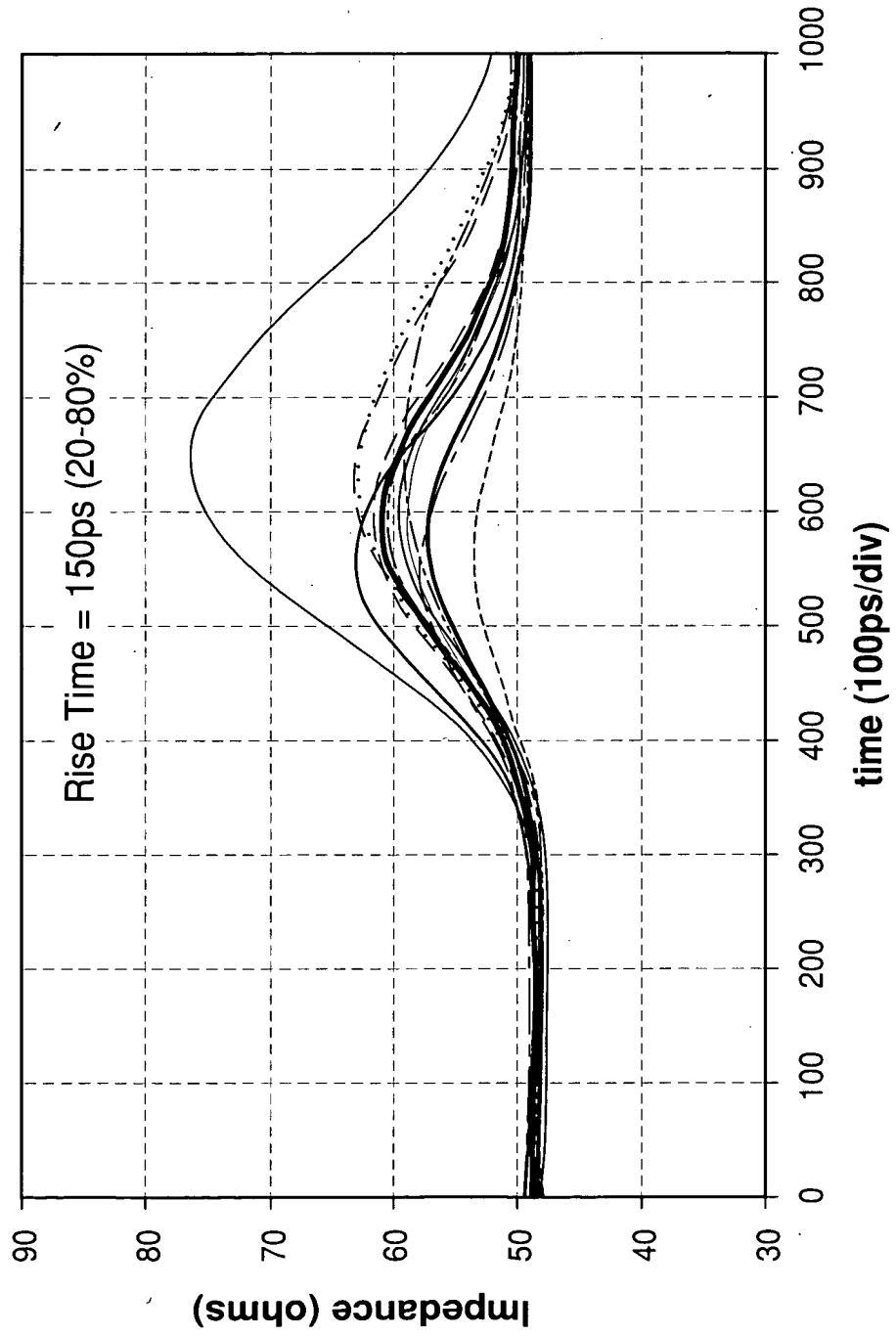
FIG. 44B

INSERTION LOSS

Single-Ended AirMax VS

	A		
	B		
	C		
	D		
	E		
	F		
	G		
	H		
	I		
	J		
	K		
	L		
	M		
	N		
	O		

Insertion Loss (dB)

Frequency (GHz)
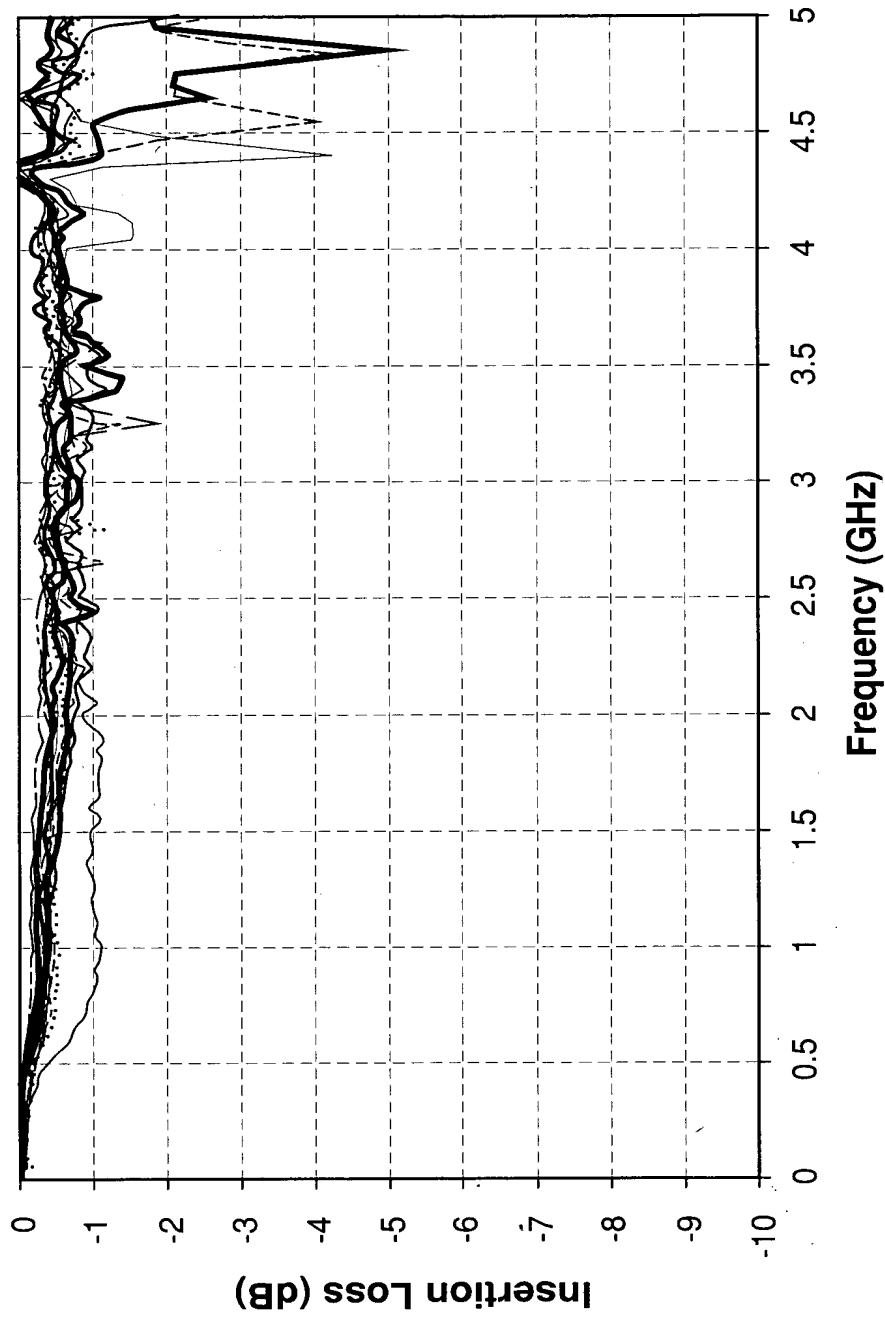
FIG. 44C

CROSSTALK

Worst-Case Multi-Active Near-End Crosstalk

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
150ps(20-80 %)	5.0	7.3	7.3	7.4	6.0	6.2	7.2	7.6	8.0	8.7	6.6	7.6	8.0	7.8	4.2

FIG. 44D

Worst-Case Multi-Active Far-End Crosstalk

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
150ps(20-80 %)	2.0	2.9	2.4	2.4	2.6	2.4	2.9	2.9	2.5	2.8	2.6	2.7	2.8	2.8	1.7

FIG. 44E

Single-Ended IMLA to Differential IMLA
Near-End Crosstalk Approximation

40ps (10-90 %)

GND						N / M	2.31	O / N
						K / J	2.13	L / K
						H / G	2.24	I / H
						E / D	2.10	F / E
						B / A	1.62	C / B

N / M	1.99	O / N
K / J	2.19	L / K
H / G	2.19	I / H
E / D	1.96	F / E
B / A	1.70	C / B
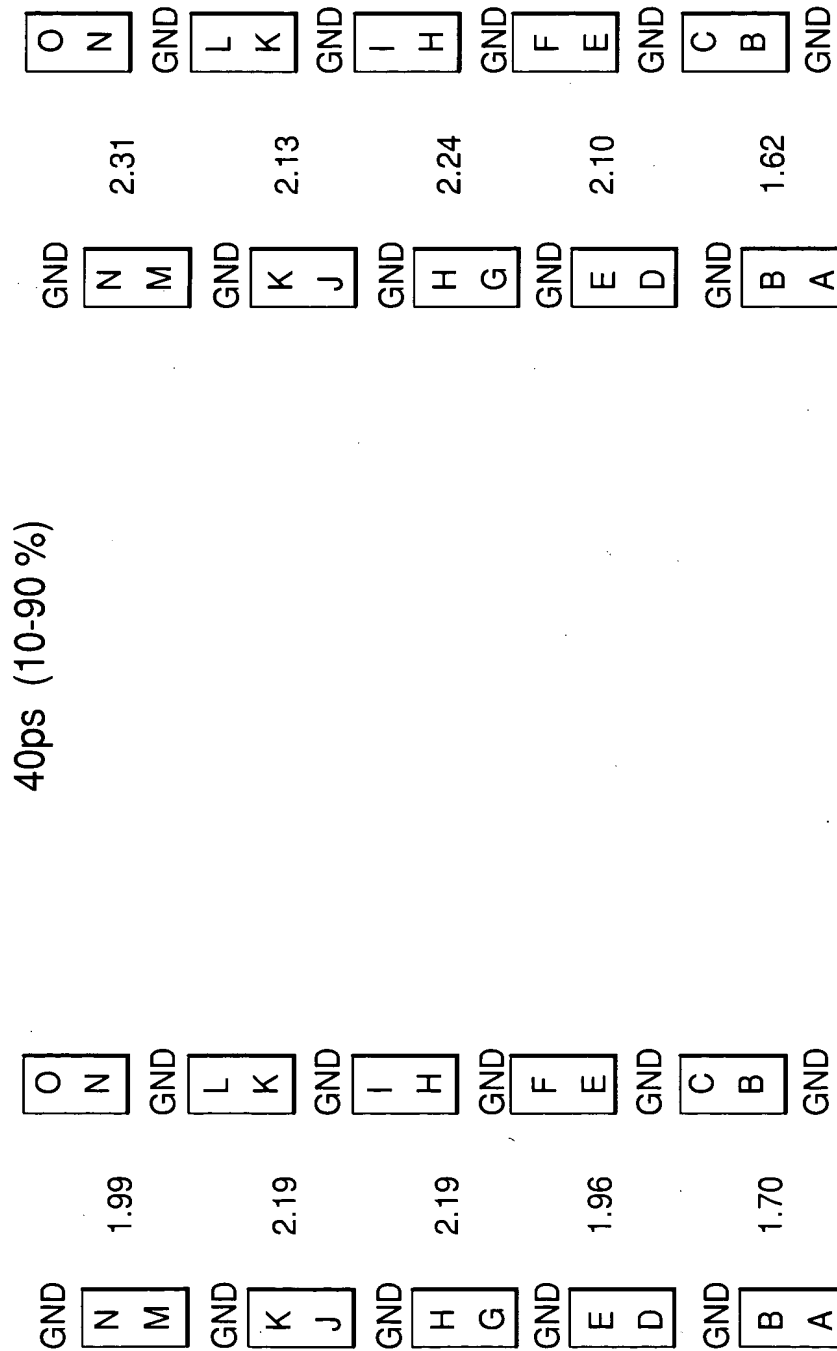
FIG. 45A

Single-Ended IMLA to Differential IMLA
Far-End Crosstalk Approximation

40ps (10-90 %)

| O | N | GND | L | K | GND | I | H | GND | F | E | GND | C | B | GND |

3.56   2.68   2.97   2.54   1.04

| GND | N | M | GND | K | J | GND | H | G | GND | E | D | GND | B | A |

| O | N | GND | L | K | GND | I | H | GND | F | E | GND | C | B | GND |

1.10   2.21   1.89   2.21   .2.40

| GND | N | M | GND | K | J | GND | H | G | GND | E | D | GND | B | A |
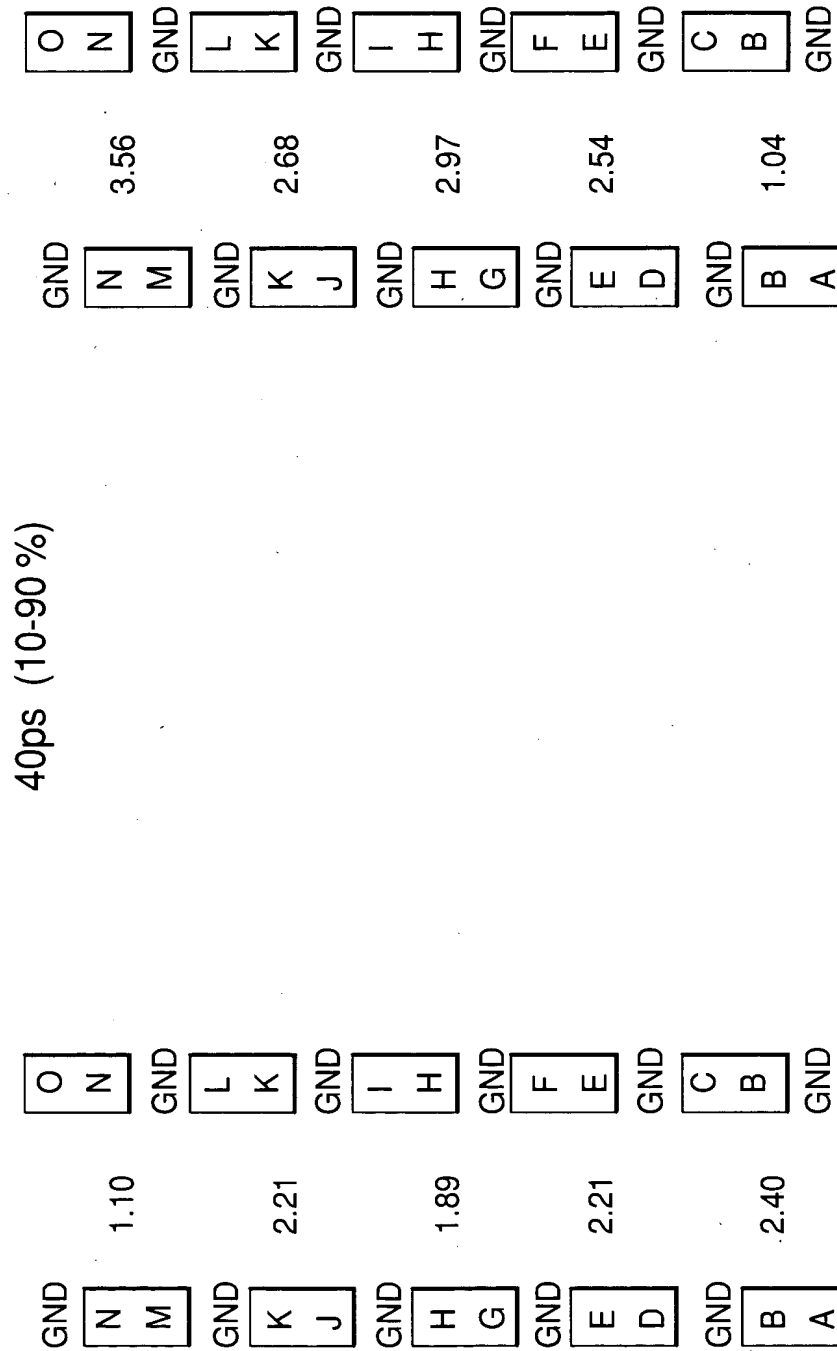
FIG. 45B

Single-Ended IMLA to Differential IMLA
Near-End Crosstalk Approximation

100ps (10-90%)

GND		O / N	
N / M	2.25	GND	
GND		L / K	
K / J	2.05	GND	
GND		I / H	
H / G	2.21	GND	
GND		F / E	
E / D	1.98	GND	
GND		C / B	
B / A	1.52	GND	

O / N		GND	
	1.88	N / M	
L / K		GND	
	2.15	K / J	
I / H		GND	
	2.16	H / G	
F / E		GND	
	1.83	E / D	
C / B		GND	
	1.62	B / A	
GND			
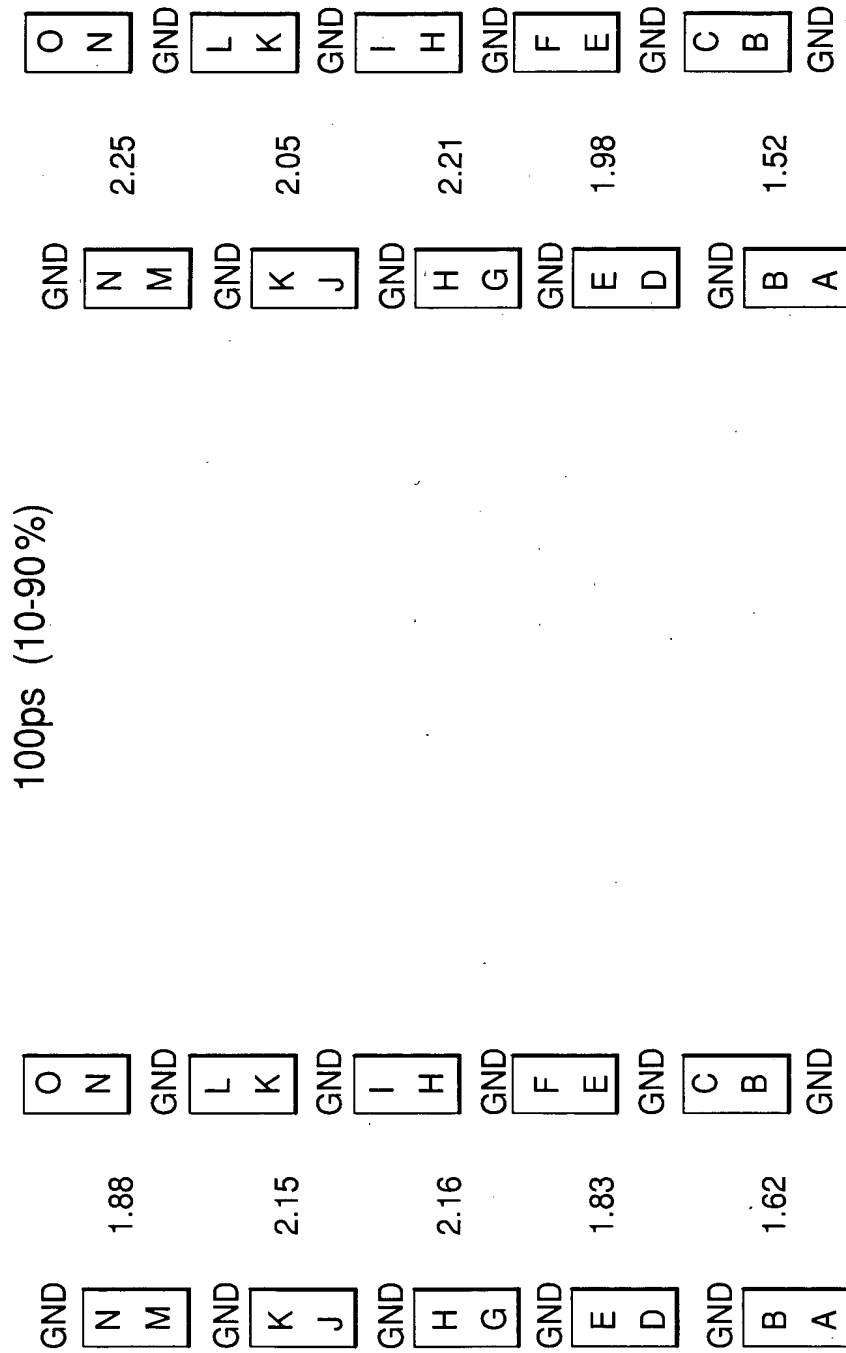
FIG. 45C

Single-Ended IMLA to Differential IMLA
Far-End Crosstalk Approximation

100ps (10-90%)

		GND					GND			
O	N		O	N			N	M		0.97
GND			GND		2.97		GND			
L	K		L	K			K	J		1.90
GND			GND		2.23		GND			
I	H		I	H			H	G		1.58
GND			GND		2.45		GND			
F	E		F	E			E	D		1.82
GND			GND		2.06		GND			
C	B		C	B			B	A		1.94
GND			GND		0.92		GND			
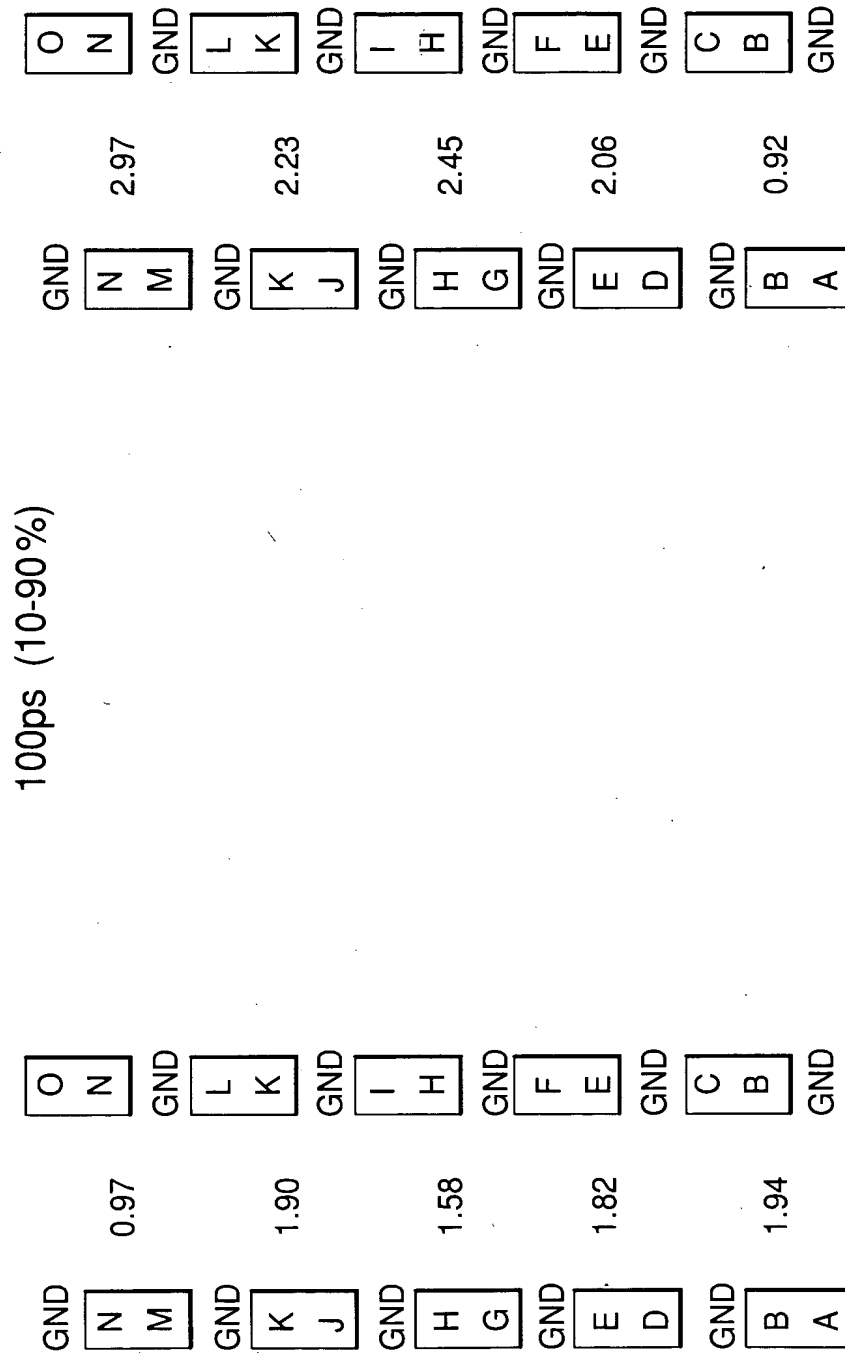
FIG. 45D

Single-Ended IMLA to Differential IMLA
Near-End Crosstalk Approximation
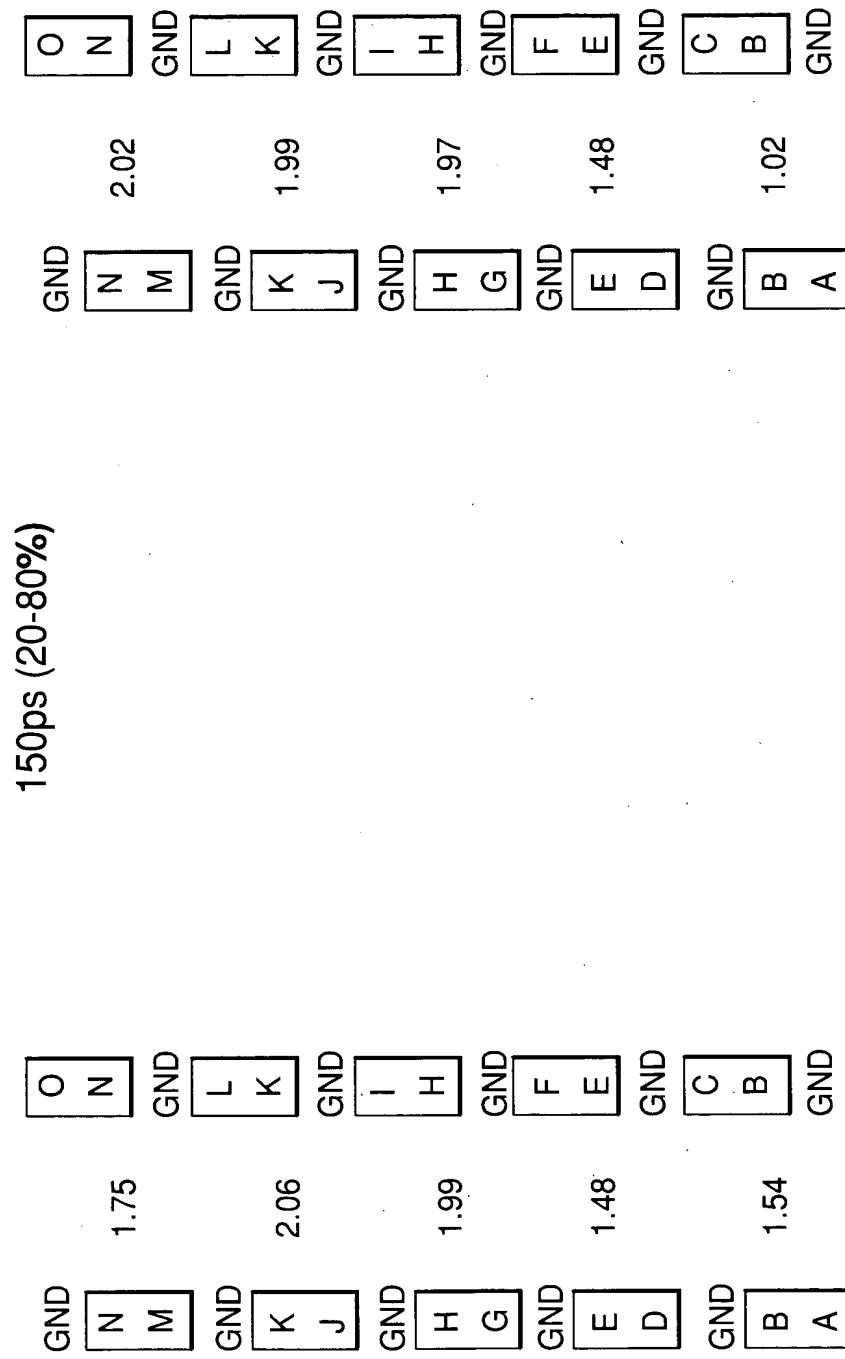
150ps (20-80%)

| GND | | | N / M | 1.75 | L / K | | GND | | K / J | 2.06 | I / H | | GND | | H / G | 1.99 | F / E | | GND | | E / D | 1.48 | C / B | | GND | | B / A | 1.54 |

| O / N | GND | N / M | 2.02 | L / K | GND | K / J | 1.99 | I / H | GND | H / G | 1.97 | F / E | GND | E / D | 1.48 | C / B | GND | B / A | 1.02 | GND |

FIG. 45E

Single-Ended IMLA to Differential IMLA
Far-End Crosstalk Approximation

150ps (20-80%)

O	N
GND	
L	K
GND	
I	H
GND	
F	E
GND	
C	B
GND	

GND	
N	M
GND	
K	J
GND	
H	G
GND	
E	D
GND	
B	A

1.62

1.22

1.29

1.08

0.52

GND	
N	M
GND	
K	J
GND	
H	G
GND	
E	D
GND	
B	A

0.62

1.14

0.93

1.00

1.06

O	N
GND	
L	K
GND	
I	H
GND	
F	E
GND	
C	B
GND	
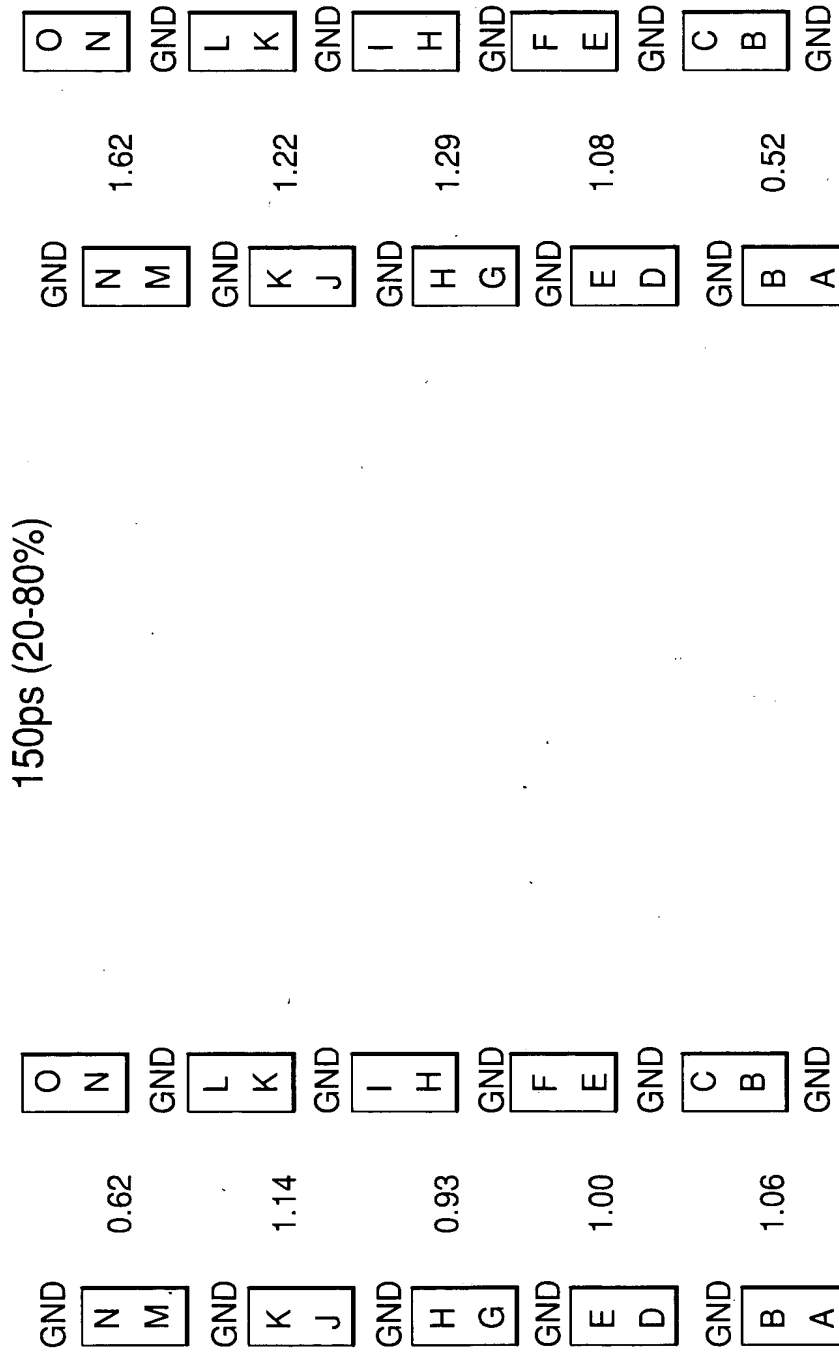
FIG. 45F

Differential IMLA to Single-Ended IMLA
Near-End Crosstalk Approximation

40ps (10-90 %)

| O | N |
| N | M |

GND

GND

1.16

| L | K |
| K | J |

GND

GND

1.07

| I | H |
| H | G |

GND

GND

1.12

| F | E |
| E | D |

GND

GND

1.05

| C | B |
| B | A |

GND

GND

0.81

| GND |
O	N
GND	1.00
L	K
GND	1.10
I	H
GND	1.10
F	E
GND	0.98
C	B
GND	0.85

N	M
K	J
H	G
E	D
B	A
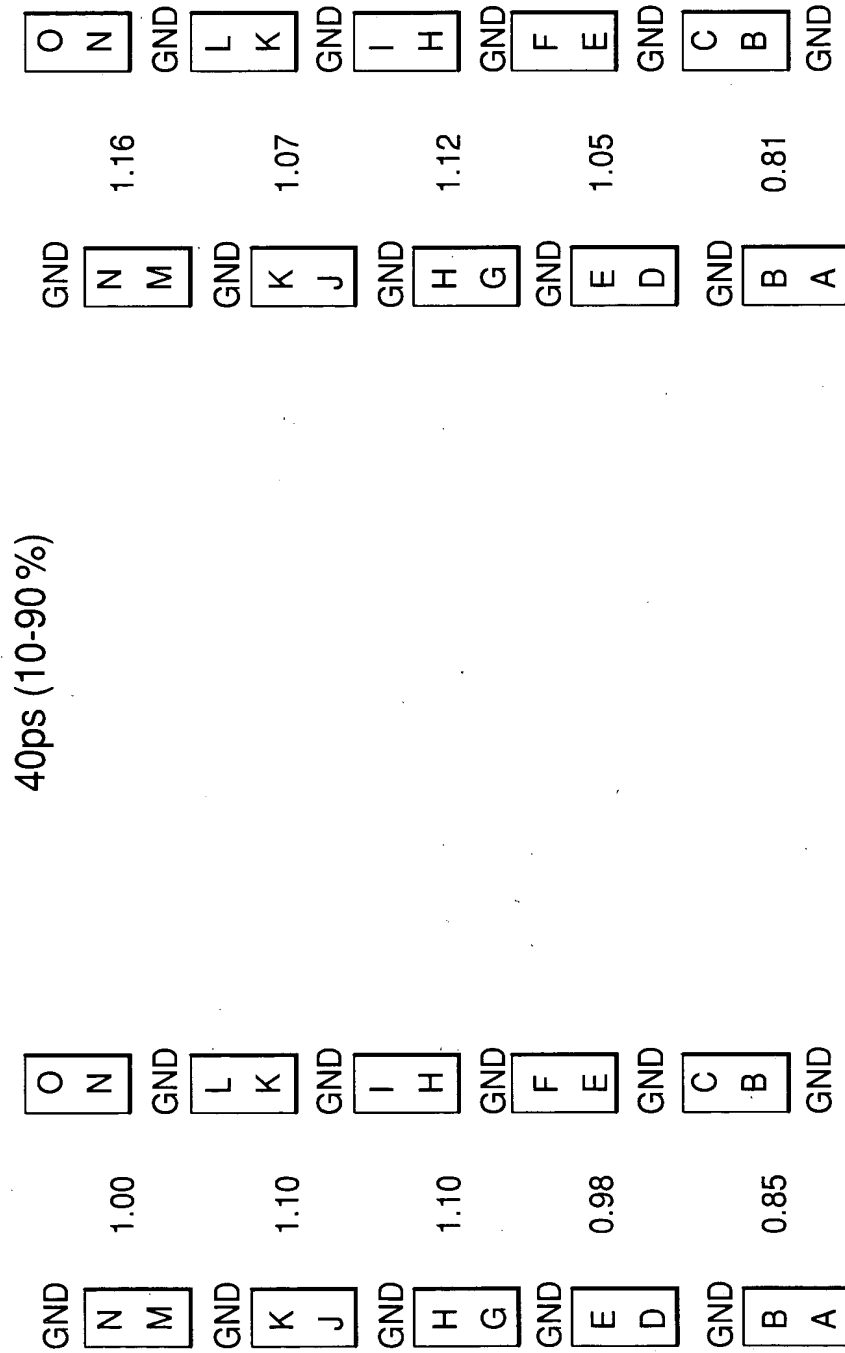
FIG. 46A

Differential IMLA to Single-Ended IMLA
Far-End Crosstalk Approximation

40ps (10-90%)

O		L		I		F		C	
N	GND	K	GND	H	GND	E	GND	B	GND

1.78 1.34 1.49 1.27 0.52

GND	N	GND	K	GND	H	GND	E	GND	B
	M		J		G		D		A

O		L		I		F		C	
N	GND	K	GND	H	GND	E	GND	B	GND

0.55 1.11 0.95 1.11 1.20

GND	N	GND	K	GND	H	GND	E	GND	B
	M		J		G		D		A
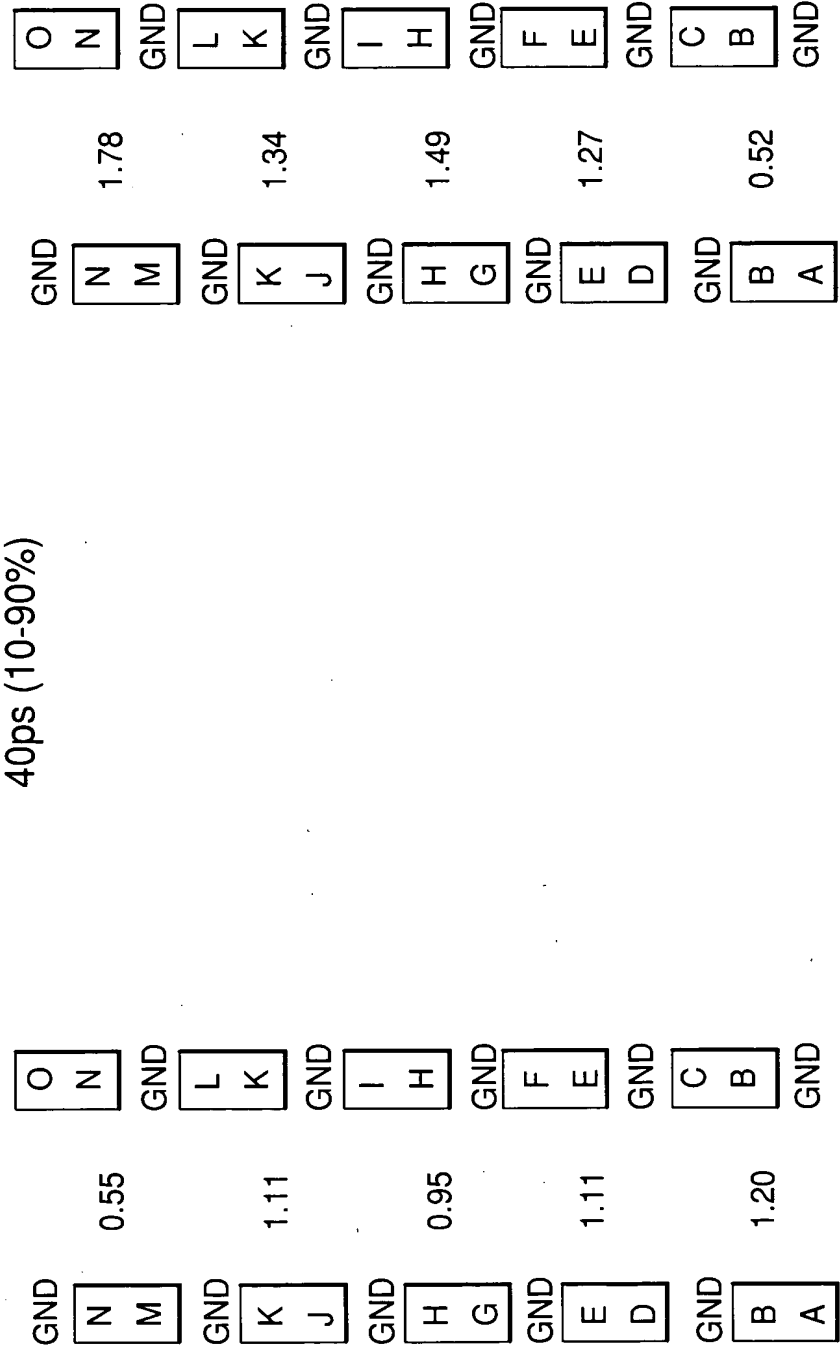
FIG. 46B

Differential IMLA to Single-Ended IMLA
Near-End Crosstalk Approximation

100ps (10-90%)

GND		O
		N
N	1.13	GND
M		L
GND		K
K	1.03	GND
J		I
GND		H
H	1.11	GND
G		F
GND		E
E	0.99	GND
D		C
GND		B
B	0.76	GND
A		

O		GND
N	0.94	N
GND		M
L		GND
K	1.08	K
GND		J
I		GND
H	1.08	H
GND		G
F		GND
E	0.92	E
GND		D
C		GND
B	0.81	B
GND		A
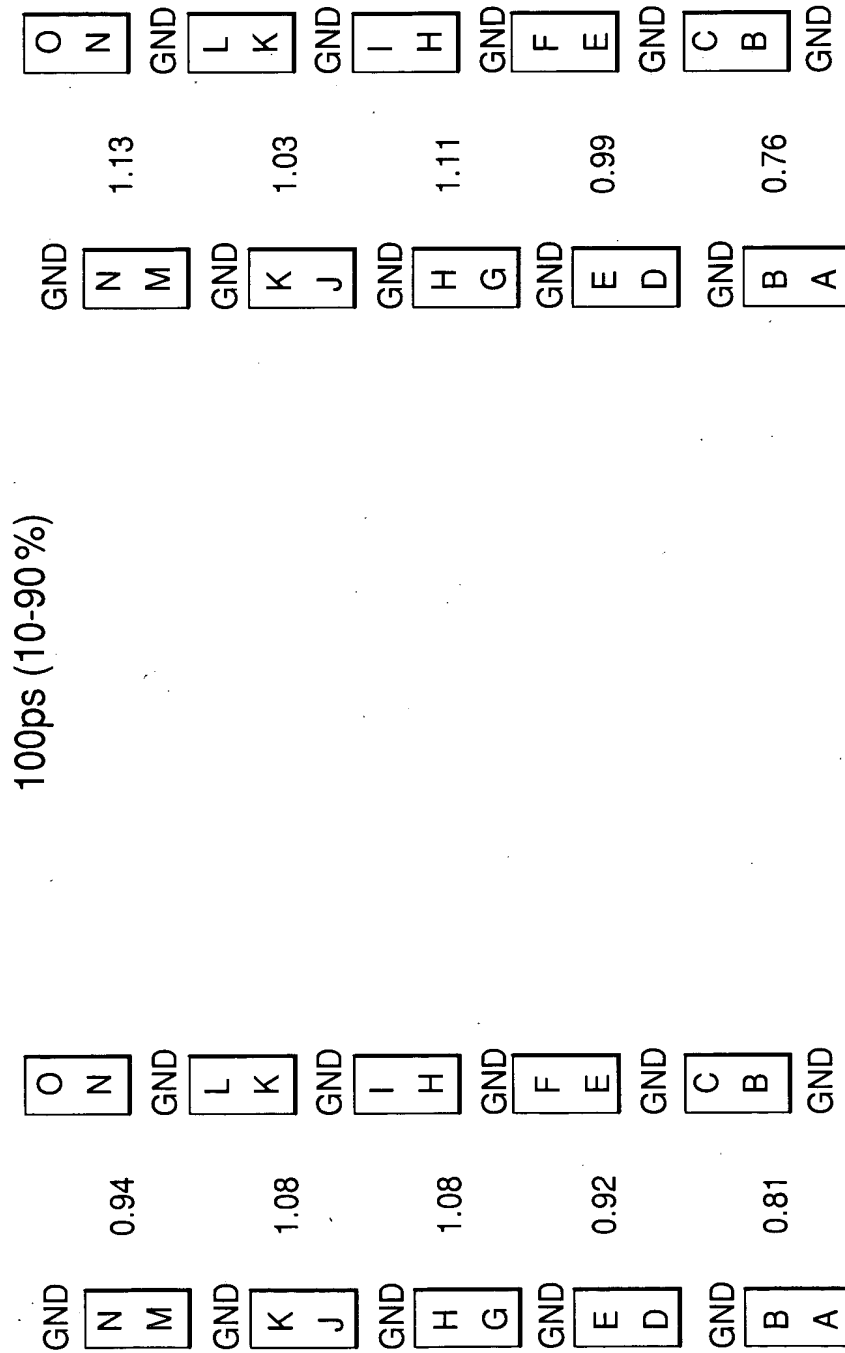
FIG. 46C

Differential IMLA to Single-Ended IMLA
Far-End Crosstalk Approximation

100ps (10-90%)

O		O
N		N
GND		GND

GND
N
M
1.49

L		L
K		K
GND		GND

GND
K
J
1.12

I		I
H		H
GND		GND

GND
H
G
1.23

F		F
E		E
GND		GND

GND
E
D
1.03

C		C
B		B
GND		GND

GND
B
A
0.46

GND
N
M
0.49

L
K
GND

GND
K
J
0.95

I
H
GND

GND
H
G
0.79

F
E
GND

GND
E
D
0.91

C
B
GND

GND
B
A
0.97
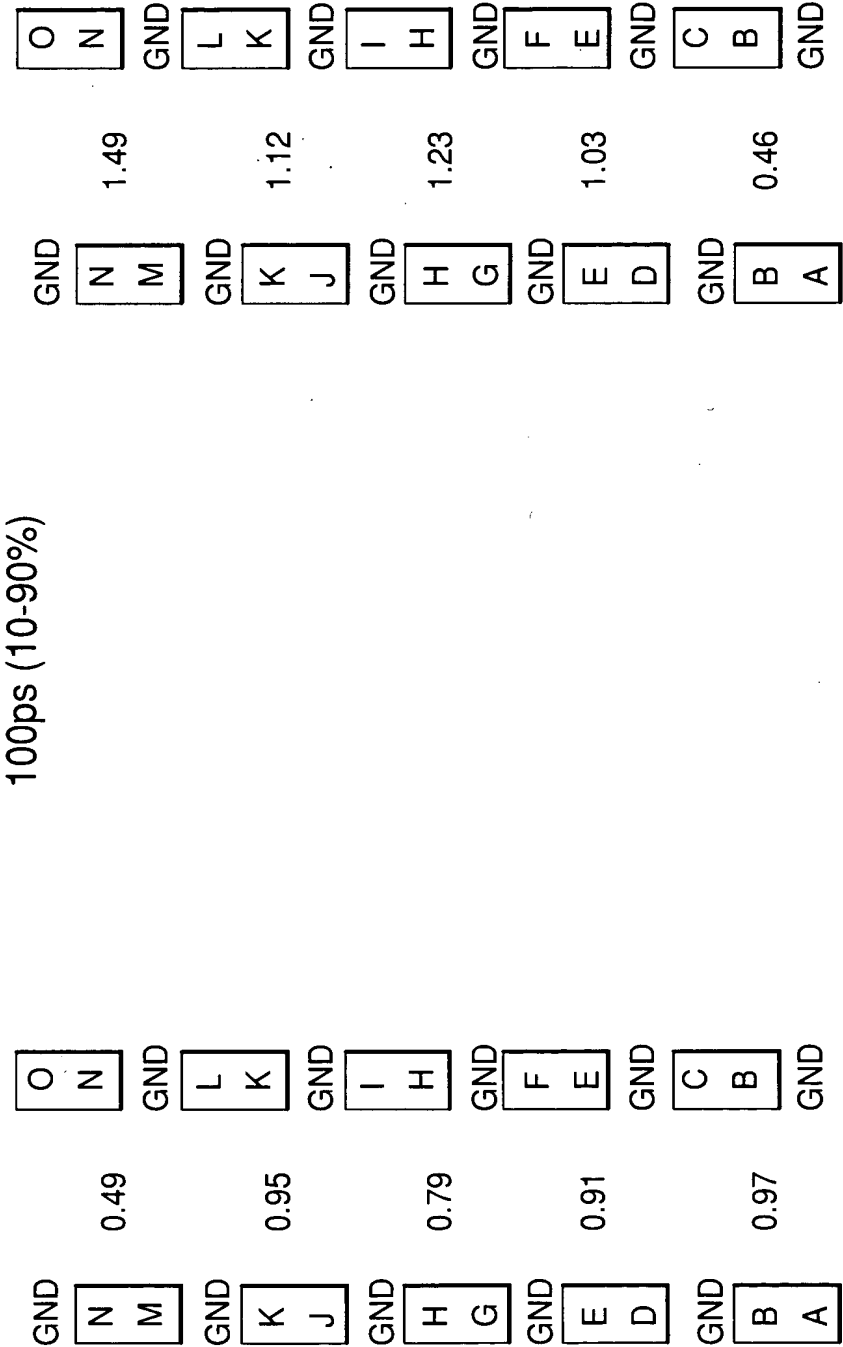
FIG. 46D

Differential IMLA to Single-Ended IMLA
Near-End Crosstalk Approximation

150ps (20-80%)

GND		GND			O / N
N / M		N / M			GND
	0.88		1.01		L / K
GND		GND			GND
K / J		K / J			I / H
	1.03		1.00		GND
GND		GND			F / E
H / G		H / G			GND
	1.00		0.99		C / B
GND		GND			GND
E / D		E / D			
	0.74		0.74		
GND		GND			
B / A		B / A			
	0.77		0.51		
GND					

FIG. 46E

Differential IMLA to Single-Ended IMLA
Far-End Crosstalk Approximation

150ps (20-80%)

GND			O	N	GND

0.81

| N | M |
| L | K | GND |

0.31

0.61

| K | J |
| I | H | GND |

0.57

0.65

| H | G |
| F | E | GND |

0.47

0.54

| E | D |
| C | B | GND |

0.50

0.26

| B | A |

0.53

FIG. 46F